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Oil-Fired Pottery

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Rochester Institute of Technology

A thesis submitted to the faculty of
the College of Fine and Applied Arts
in candidacy for the degree of
Master of Fine Arts

Oil-Fired Pottery

by

Peter Morgan Regan

Date: March 12, 1979

APPROVALS

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Date: 4/27/1979

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Date: March 12, 1979

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Introduction

This paper begins where I began; with an idea. I have tried to explain clearly the construction of the kiln with the aid of illustrations. The text on the kiln and its operation reflect my experience with my kiln. The section on my ware is complemented with illustrations in the hopes that some connection with the written text will be evident. The appendix includes items containing important information dealing with the kiln and its operation, and the bibliography includes books that directly influenced my project and my work. Much, no doubt, is unaccounted for.

Thank You!

Special thanks for their help in solving technical and aesthetic matters should go to the following people:

Dr. Robert Johnston

Robert Schmitz

Hobart Cowles

William Troxell

Neal Redmond

Dennis Parks

Meabs

Robert Palusky

Angela Fina

Leonard Dowhie

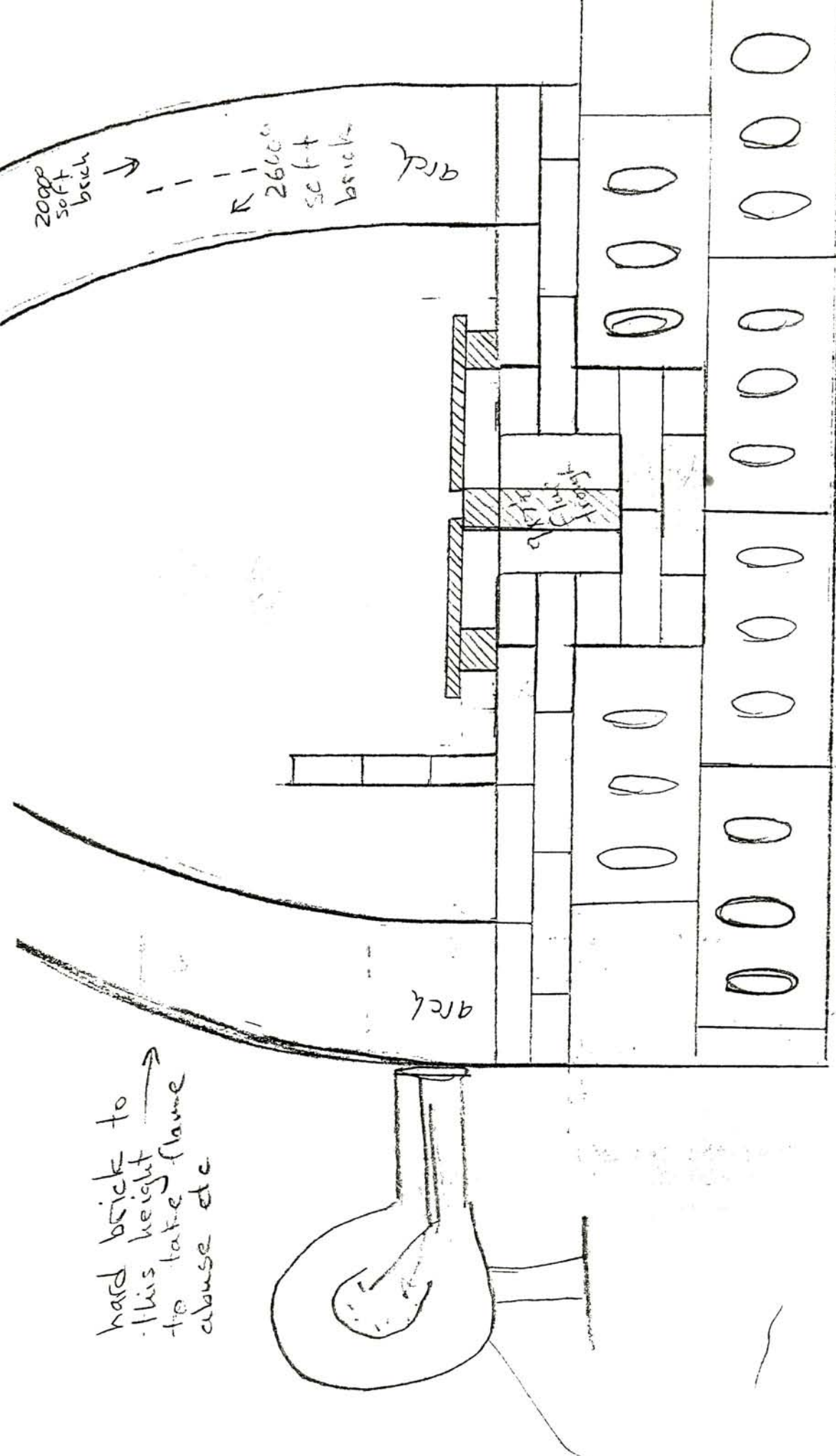
Jerry Dodd

Sprontz Incineration

Langie Fuel Co.

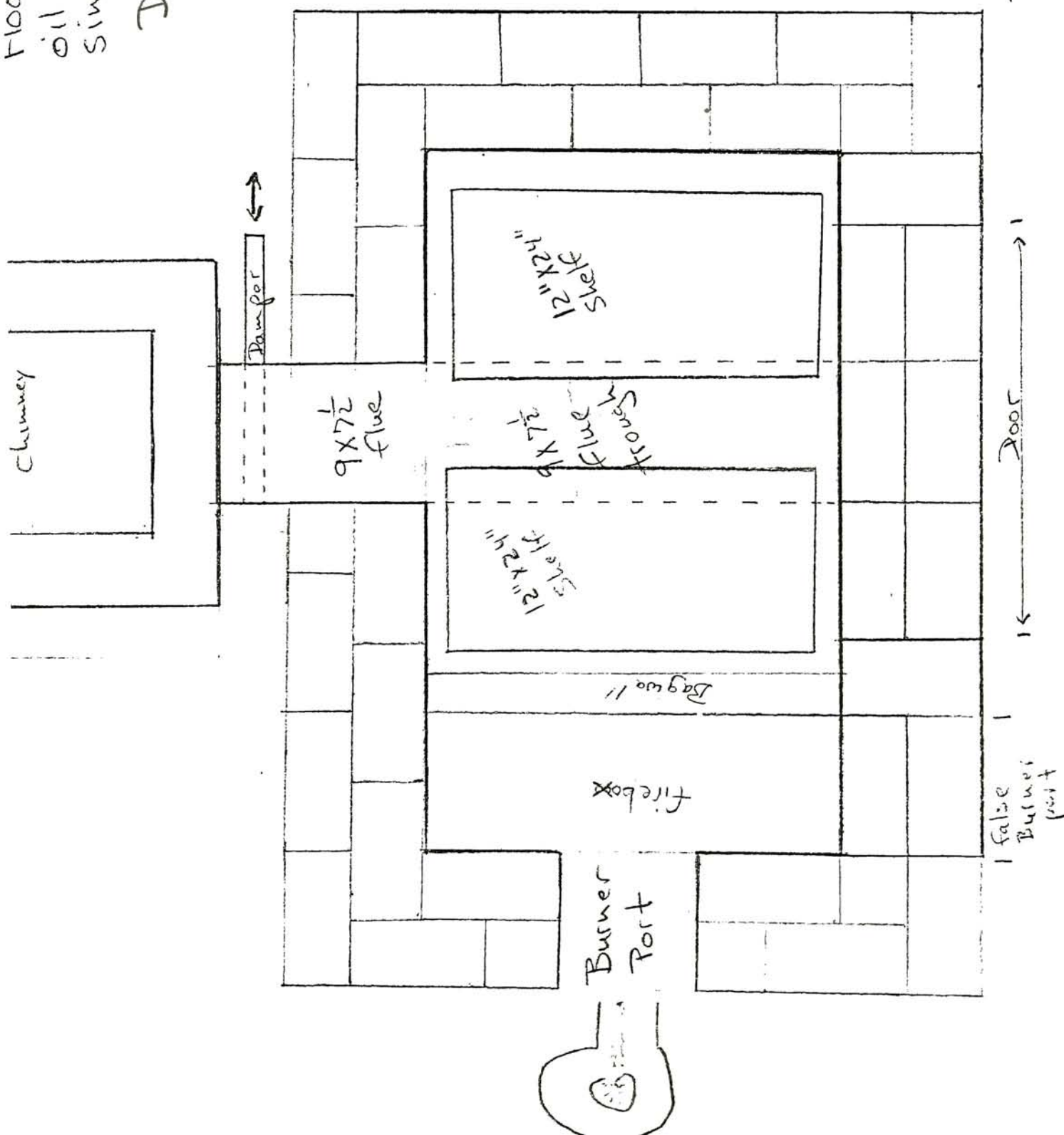
Barklund Heating Co.

All the potters who have shared their experiences and ideas so that others might benefit and learn.



Catevany arch
cross section
oil Kiln
9/26/78
Diagram

Floor Plan 7/10/12
 oil filler
 single burner
 Diagram 2



Part I

THE KILN

Construction diagrams and illustrations

Figure 1 shows the flue trough being laid-in with hard firebrick up to the level of the concrete blocks. The blocks are laid in dry with the holes lining up for ventilation. The chimney and flue can be seen to the right.

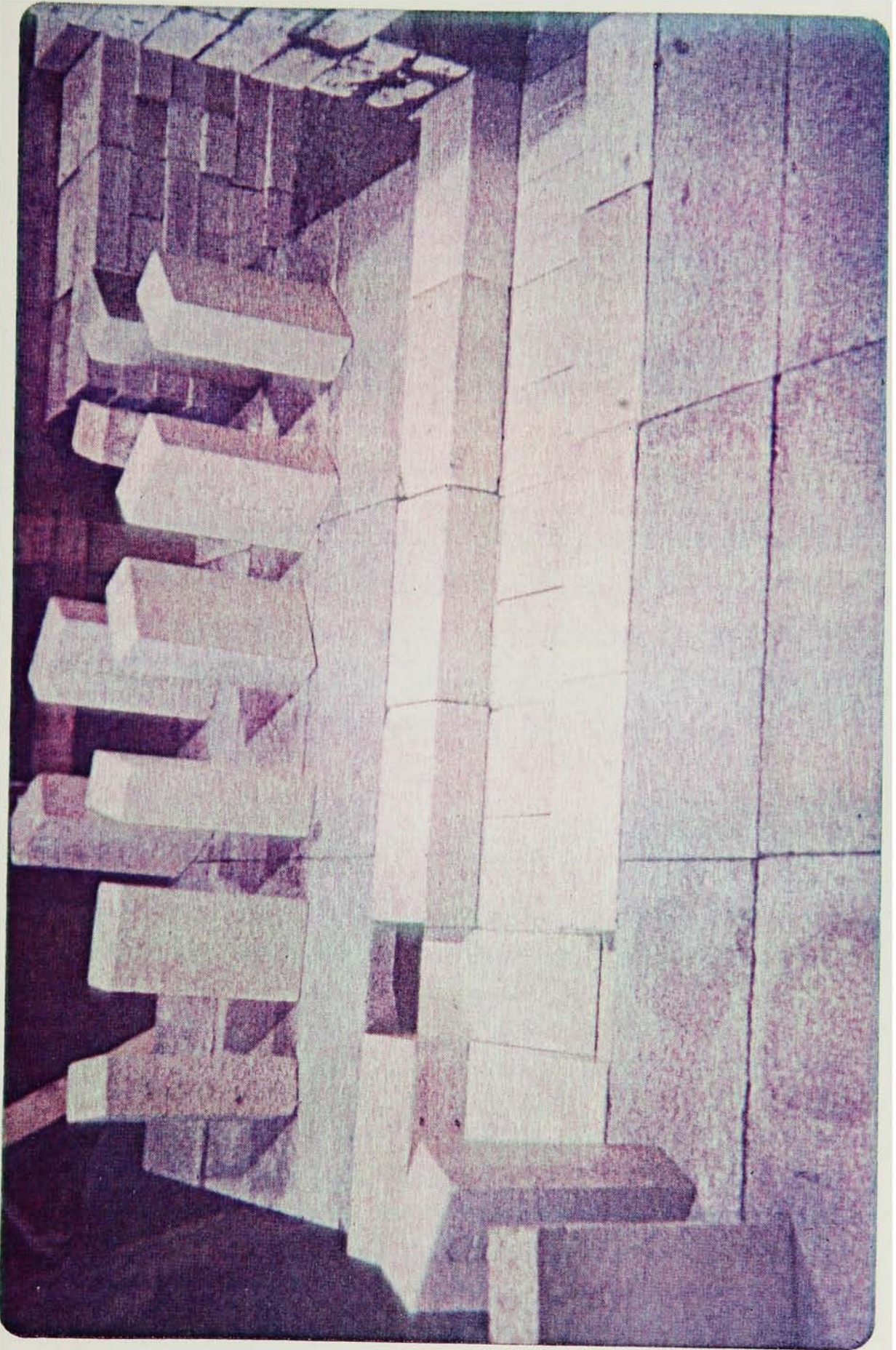


Figure 2 shows the completed kiln floor which is made up of two layers of hard brick. In the rear, the flue has been bridged over where the back wall of the kiln will be. The extra floor space to the left of the flue trough allows for the firebox area, thus maintaining a central flue trough in the chamber.

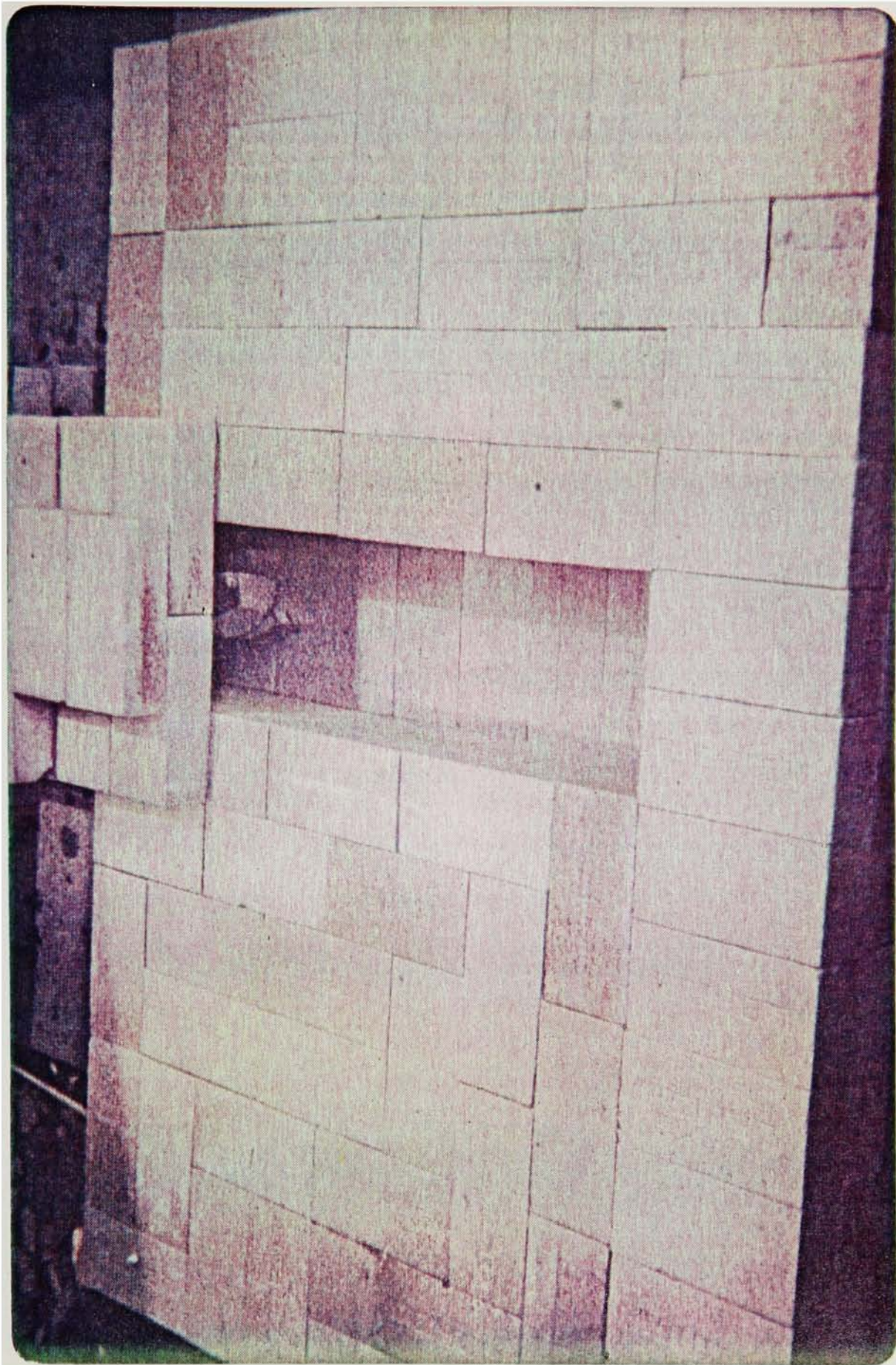


Figure 3 shows the completed catenary arch form made up of plywood and $1/8$ " masonite with 2" x 4" bracing. The curve is approximately as high as it is wide and is established by hanging a chain on the plywood and tracing the curve that results. Behind the form, one can see the $13\frac{1}{2}$ " x $13\frac{1}{2}$ " hardbrick chimney which the oil kiln and wood kiln will share.

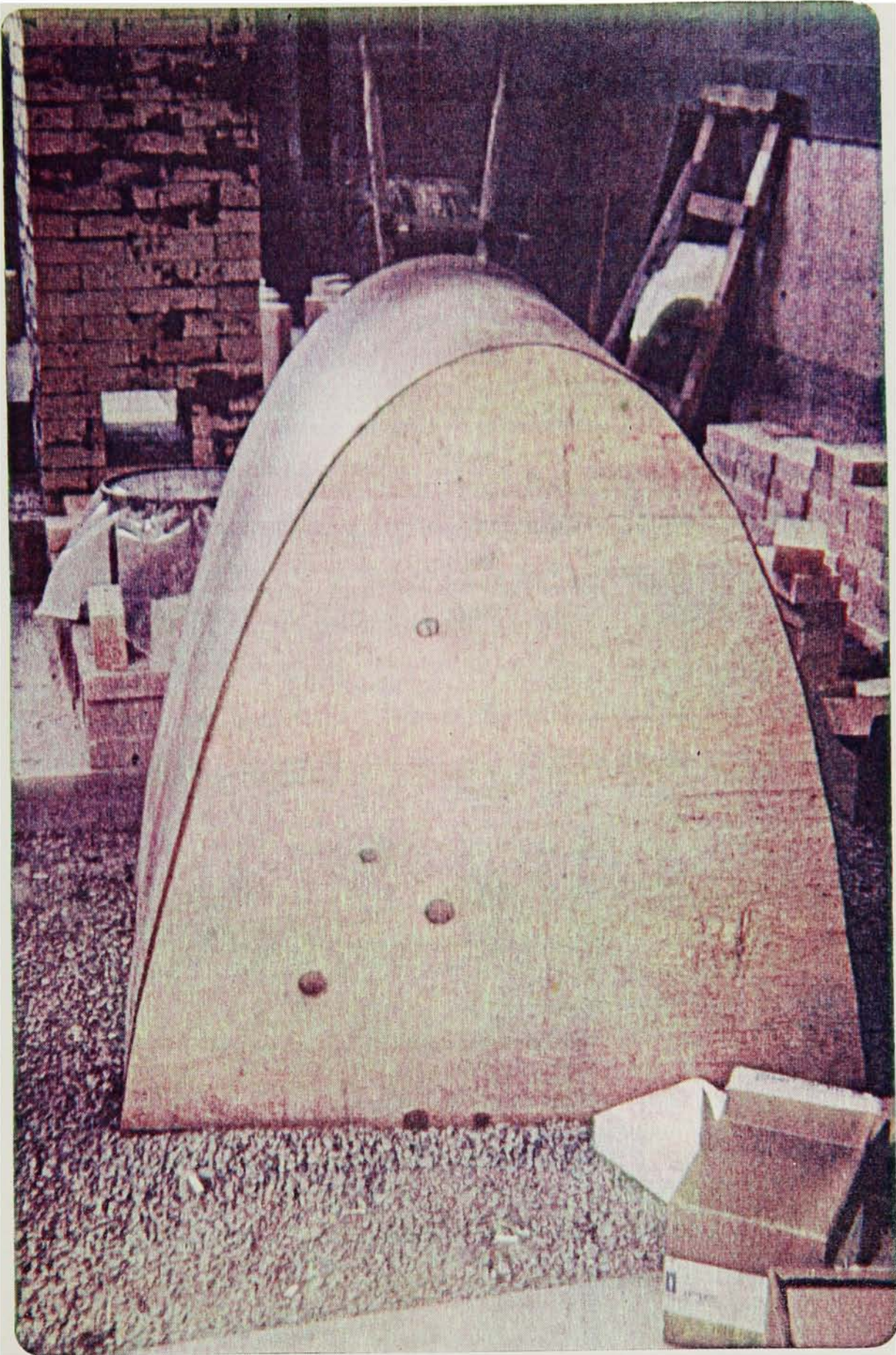
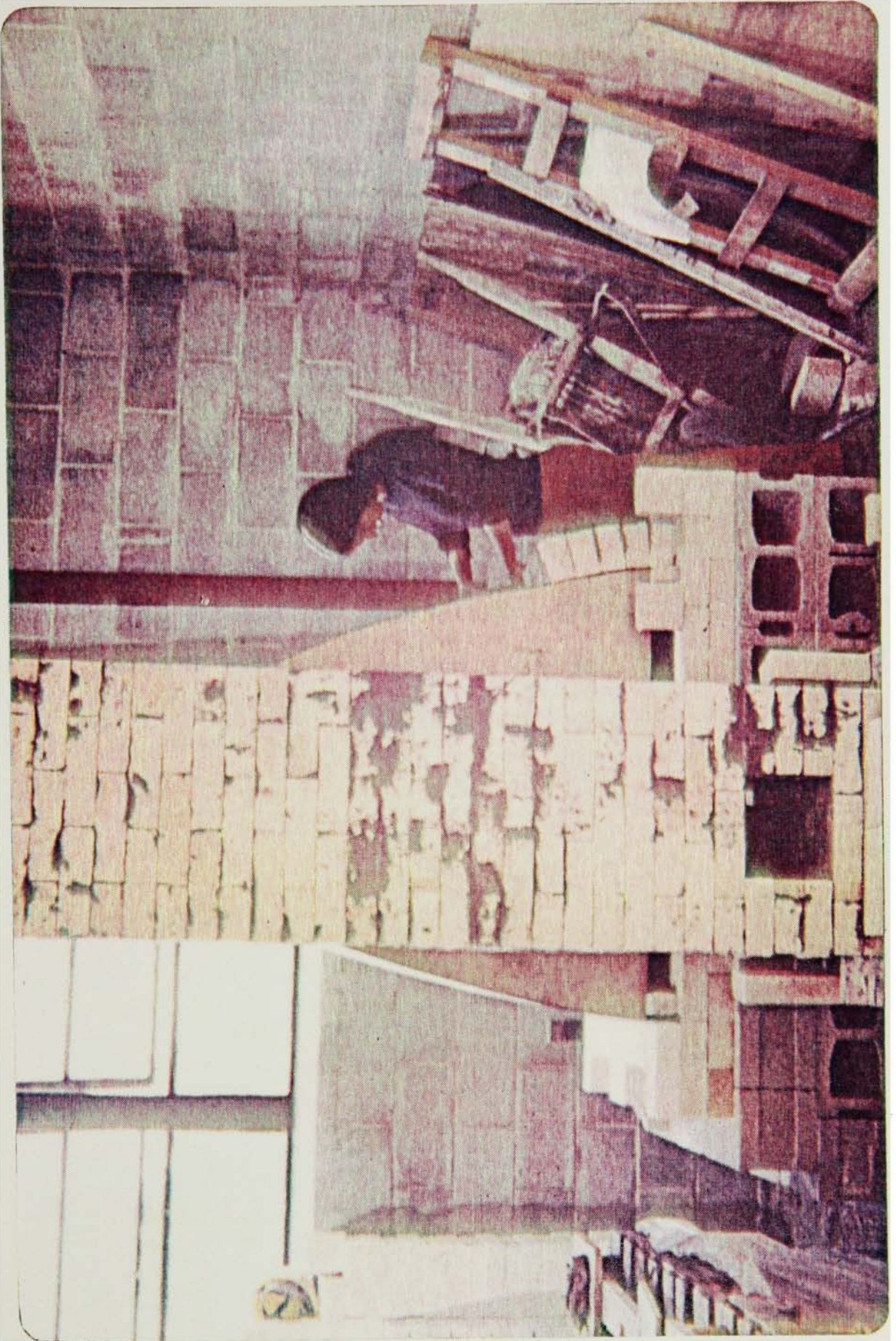


Figure 4 shows my assistant beginning to construct the arch. A 50 "Missouri" fireclay - 50 "G" Grog stiff mortar was used to angle the bricks to make them conform to the catenary curve. Note that hard firebrick is being used on the right where the firebox will be versus 2600°F insulating firebrick on the left. Also note that the form has been propped up on blocks so that when the arch is completed the blocks can be knocked out and the form removed.



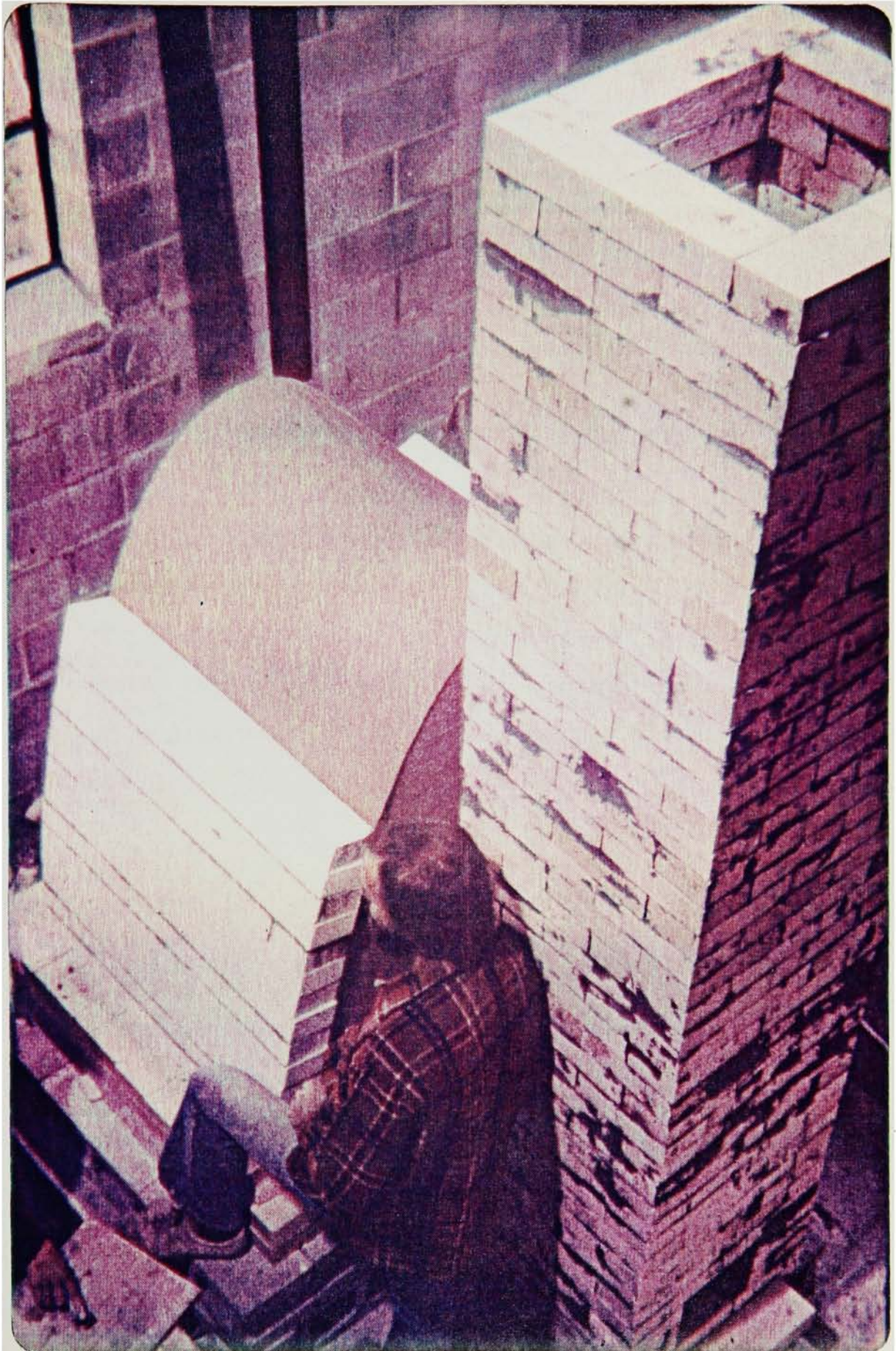


Figure 6 shows the completed burner port. The second layer of 2000°F insulating brick has been added to the arch and the front of the kiln has been stacked up. This burner port was later filled in, in favor of the false burner port left in the front wall. (See construction diagram 2) This gave more room for the oil to burn.



Figure 7 shows the completed arch with the blocks ready to be knocked out and the arch form removed.

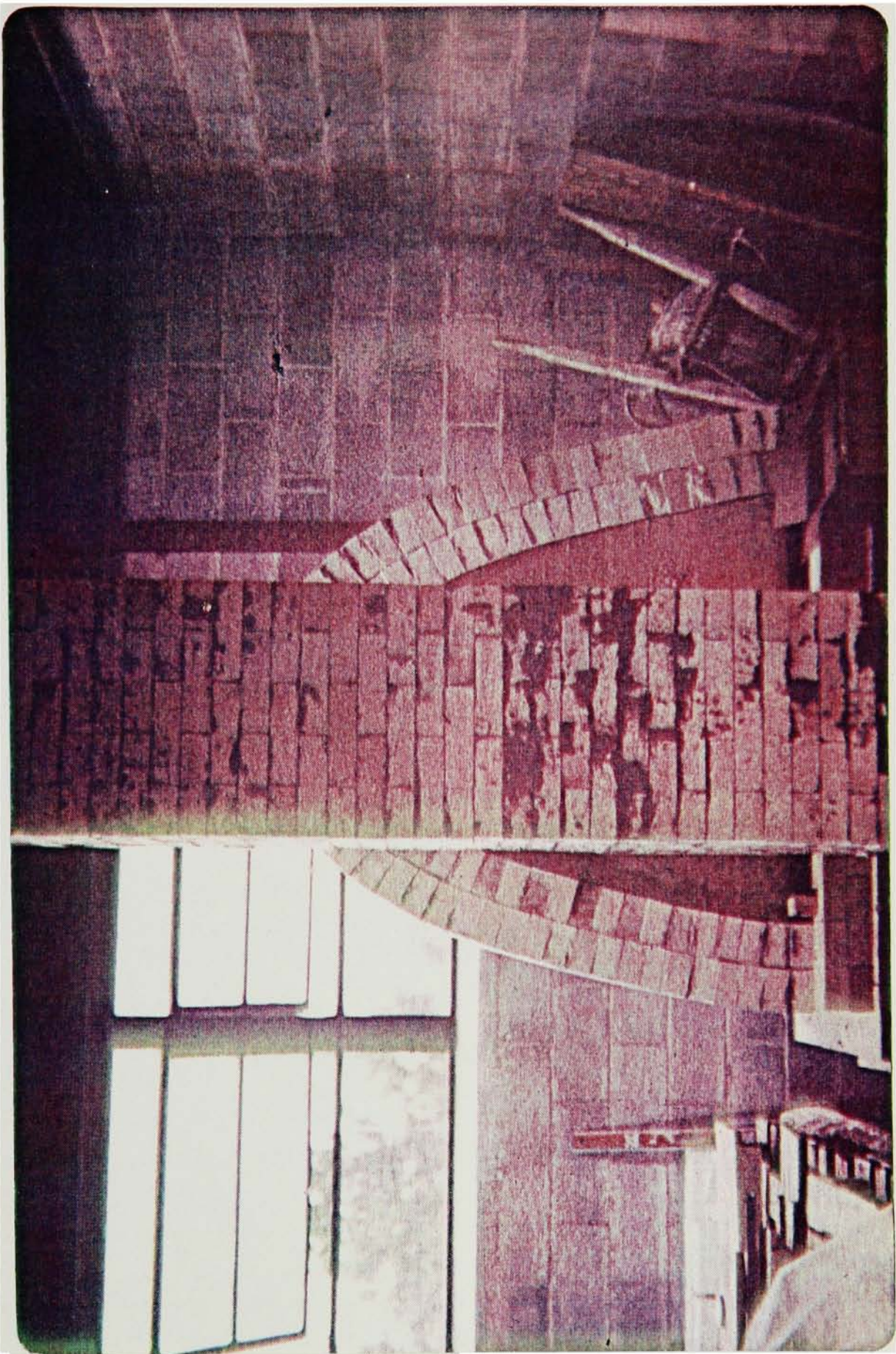


Figure 8 shows a detail of the first row of insulating bricks on the arch. Note that as the curve became more intense toward the top, the bricks were custom cut to make the proper angle.

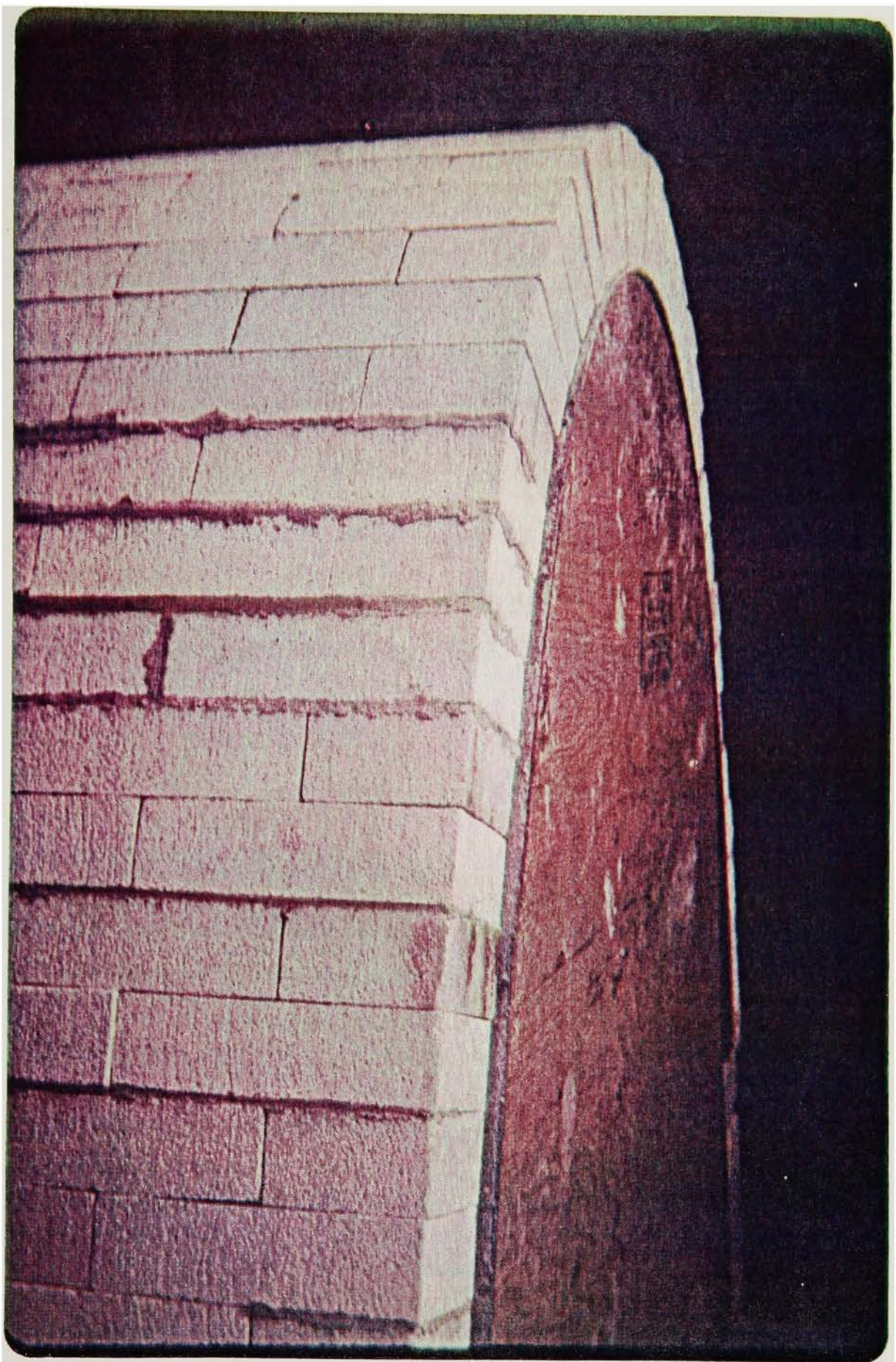


Figure 9 shows the arch again, this time with the back up layer of 2000°F insulating brick having been added.

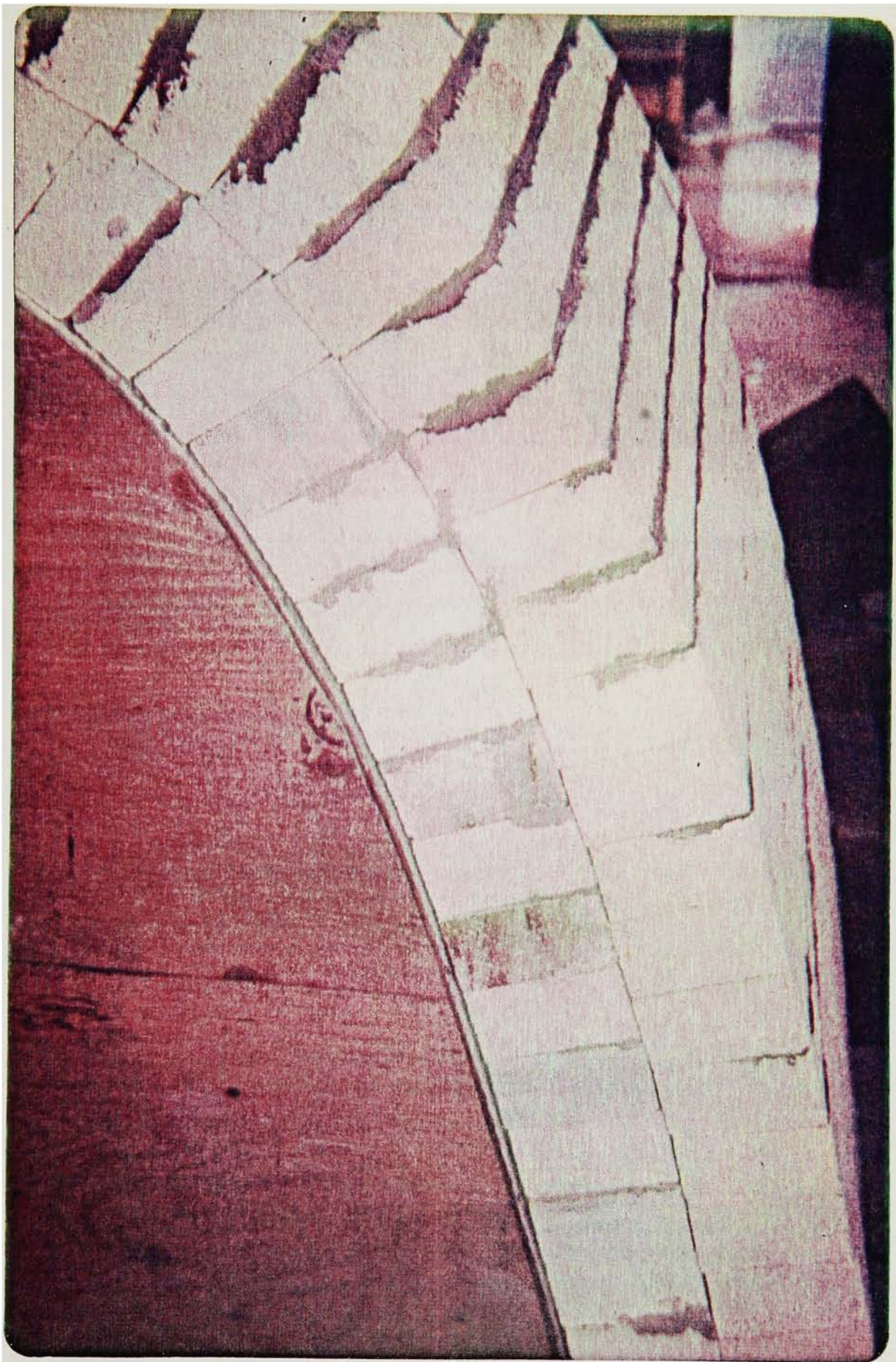


Figure 10 shows high drama. The blocks that held up the arch form have been removed and the arch is now free standing.

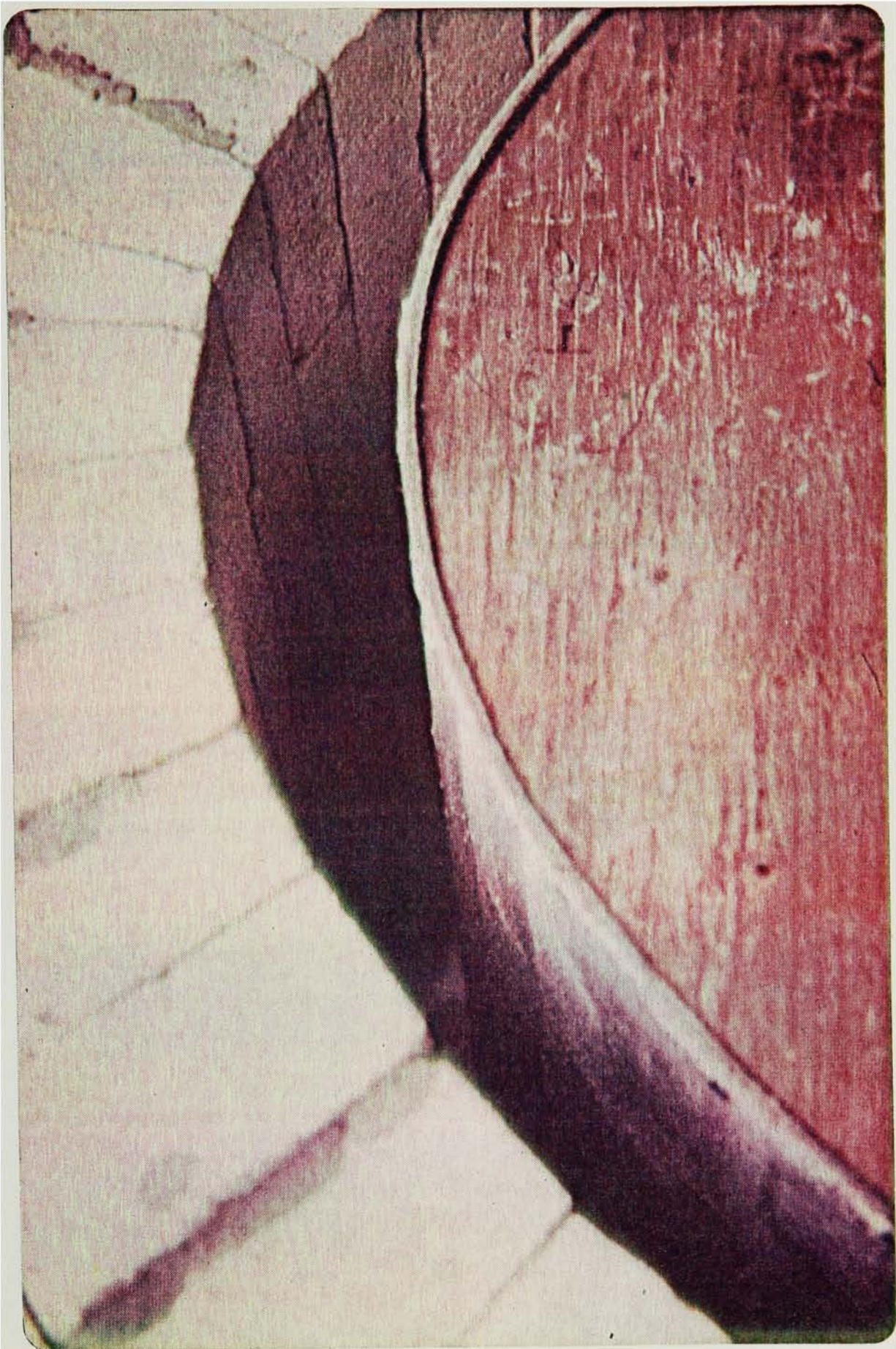


Figure 11 shows the arch form being removed. Note that the form still has the ghost-like impressions of the bricks on it.

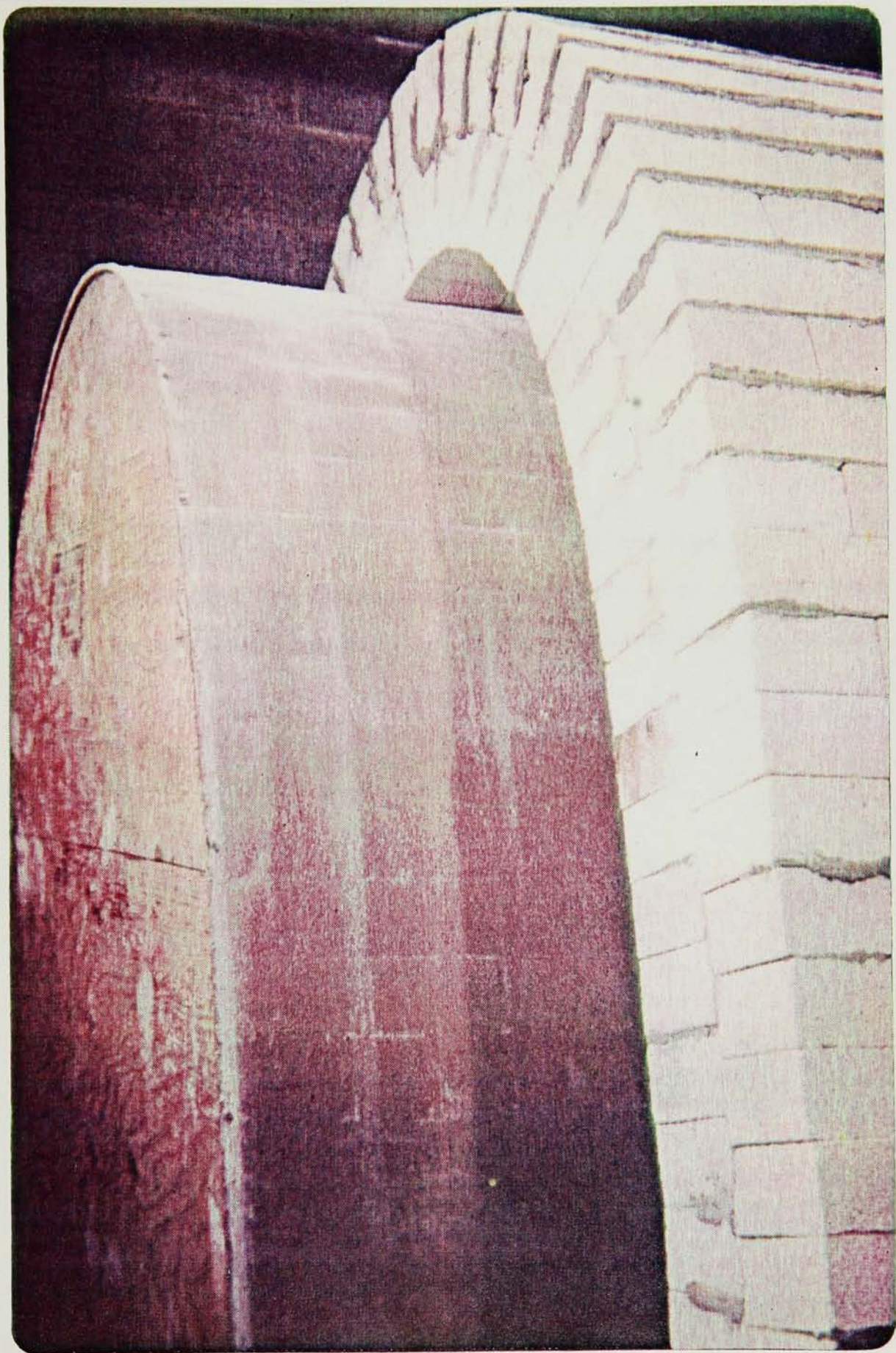


Figure 12 shows the completed kiln and the arch form which was cut and inverted to form a rack for the door bricks, thus preventing mix ups and random stacking.

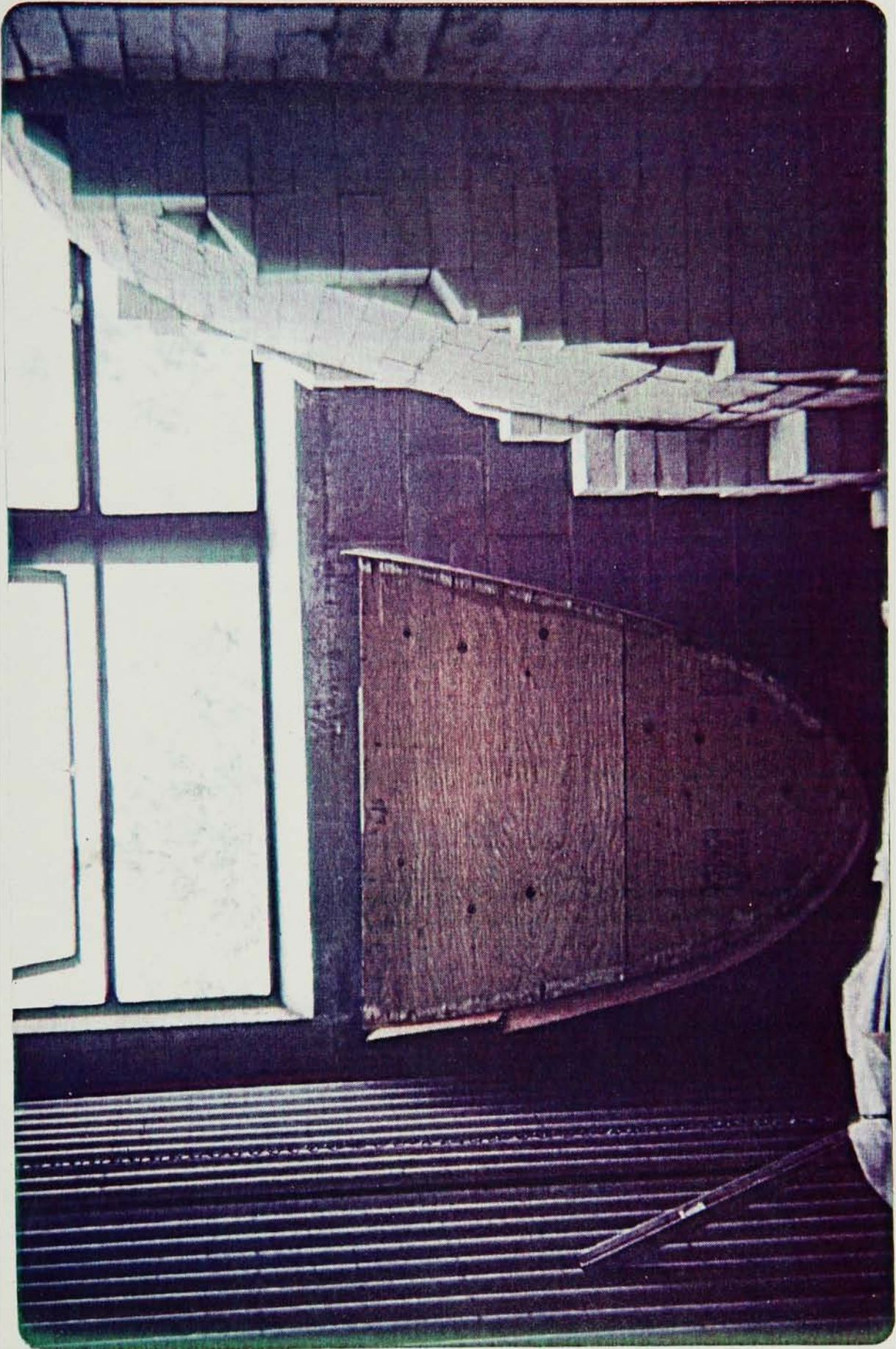


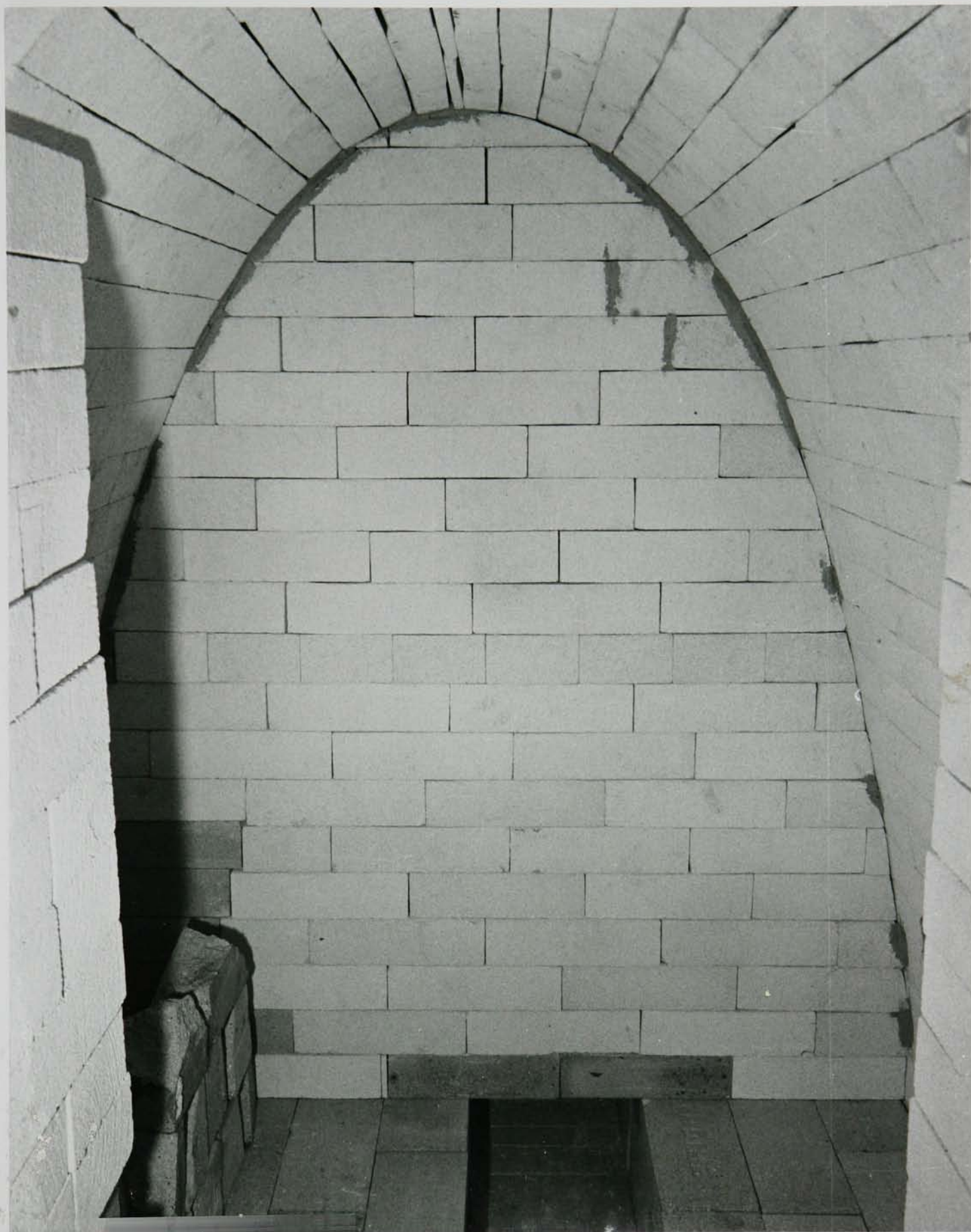
Figure 13 shows the finished kiln. Note the burner port to the left of the door. The plastic was used to protect the porous insulating brick from the rain before the chimney was hooked up.



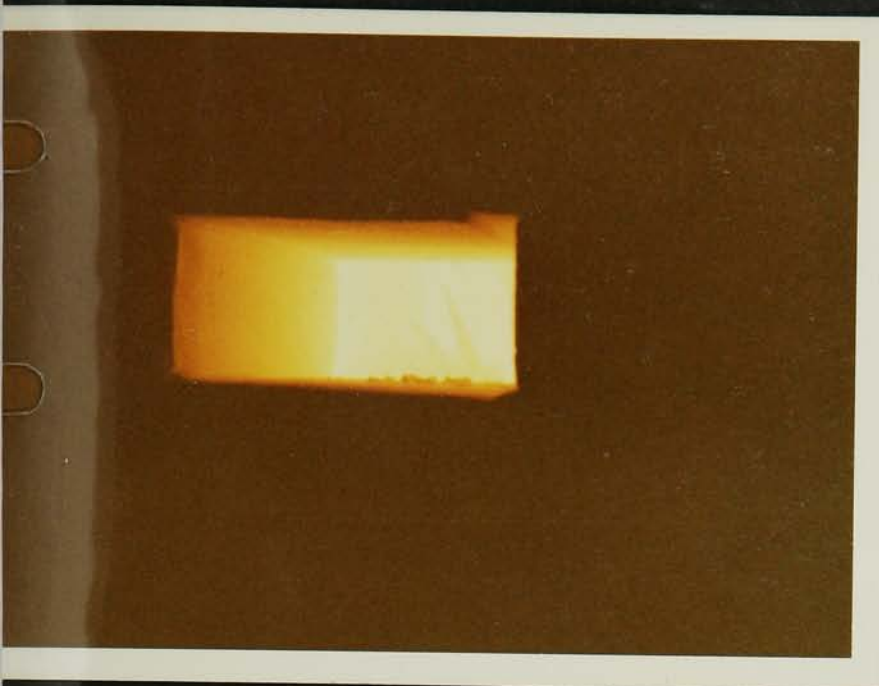
Figure 14 shows the interior of the kiln, the flue trough and bag wall to the left. The kiln has about 20 cubic feet of loading space.



Figure 15 is another shot of the interior space of the kiln, dramatizing the beauty of the catenary curve.



The color photographs show the kiln firing with one oil burner.



THE OIL KILN AND ITS OPERATION

I became interested in oil firing, innocently enough, through my research and readings into kiln design and firing. Initially, it interested me only in that I either knew or had read about potters who had used oil to fire their ware. When presented with the opportunity to do a thesis project that would involve my last 2 quarters at R.I.T., I began to look more closely into oil firing as a means of killing many birds with one stone. It would offer me a chance to try something new and something that was beginning to intrigue me more and more, and it would fire my pottery. Best of all, however, it would present a challenge to me in that I would be responsible for building the kiln and finding some way of firing it. This became very important to me as I realized the self-confidence that would develop as a result of having tackled such a challenge. This self-confidence, I reasoned, would be of great use when I first set out as an independent craftsman. It did not matter that kilns had been built before and fired with oil. I hadn't built one and the challenge remained fresh and unsolved for me. In addition, I had made the jump from gas to wood and wood to gas without ever examining the middle ground that oil represents, not solid, not gas, but liquid! Furthermore, the subject had never been dealt with at R.I.T. and I hoped to compile information on the topic for use by other

craftsmen who might see some of the same opportunities that I did in using fuel oil.

Thus I set about honing the project down to something manageable in 2 quarters' time and proceeded to begin my research and reading into the subject. For many older potters, oil firing became the logical follow-up to wood firing, requiring less work and yielding similar results. Leach's discussion of the transition from wood to oil hits on many of the pros and cons of oil firing.

You are already familiar with our former wood firing of this kiln, so it may interest you to hear what we have done to make the change over to atomized oil, and the results obtained. ... The problem of how to apply oil-burning exercised us for several years. ... At first we had a little difficulty in learning how to regulate the air and oil mixture to get similar results to those obtained by the larger and gentler flames from wood. As far as the kiln and the pots are concerned the same principles of firing hold good. The severity of the oil blast ensures a much quicker rise of temperature, and it is more difficult to distinguish between oxidation and reduction by the appearance of the flame and smoke from the blowholes and chimney. Reduction is indicated by far less smoke from oil than from wood, and even in our kiln where the chimney is very short, considerable restraint has to be used to avoid flashed firing of glazes. After the long struggles we have experienced in obtaining white heat with wood, it is a great relief to have this sense of reserved power, but it has to be used with discretion. Instead of the twenty-five to thirty hours

the time has been reduced to from fifteen to twenty, and the hard labour of cutting and stoking has almost been eliminated. ... By two o'clock, after twenty hours of stoking, the firing was done, and we shut off the oil, clammed up the fire-mouths, closed the blowholes, cleared away all wood and other inflammable matter from near the kiln, and went to bed tired, but not exhausted as in the old days.¹

Daniel Rhodes and Fred Olsen, in their books on kilns, offered sketchy advice and suggestions. About this time, I had discovered articles in "Pottery Quarterly" and "Pottery in Australia" (See bibliography) about oil firing which seems more prevalent in those countries than here in the United States. I knew of Dennis Parks in Tuscarora, Nevada, the infamous single-fire potter and frequent contributor to "Studio Potter." It was, in fact, from an article in "Studio Potter" that I first learned about the possibility of using a standard gun-type oil furnace burner to fire a kiln.² While the highly engineered burner seemed overly complex, it did have one great advantage. Since the burner is used so widely for heating homes, it is very highly engineered to be efficient and safe, having its own built-in safety system. This last feature proved to be the deciding factor when it came to my project being accepted or rejected by the Institute.

It seemed to me, from my reading, that the use of such a burner would be much cheaper and more efficient

than gas or wood as a fuel for a potter who was setting up a kiln on a limited budget. The burner itself can be bought for under \$25 and is not as complicated as it looks. (See diagram of burner parts in appendix). Since two such burners could fire a kiln that might otherwise need four to six gas burners, a great savings could be realized, while still maintaining a very safe and efficient firing system. A comparable system for use with propane or natural gas might run hundreds of dollars per burner. The storage of oil presents another area where great savings can be had over gas kilns. A gas kiln needs a large storage tank which should be buried and requires rather elaborate and well done plumbing. The oil kiln, on the other hand, can once again use a cheap, readily available, engineered and safe storage tank. My kiln, being small and temporary in nature, uses a 55 gallon oil drum which holds enough fuel oil for 2 glaze firings (cone 10). A better solution would be to buy a 275 gallon tank (the standard oil tank found in many homes). They are available for less than \$50, and provide a considerable storage capacity. In addition, the plumbing is less critical and a leak is easily detected and potentially much less dangerous. This feature makes it considerably safer than a gas kiln where one must rely on one's sense of smell to detect any leaks. Even if one were lucky enough to be able to get natural

gas, the cost of a meter, burners and proper safety equipment, still make the use of oil burners seem cheap.

Oil, itself, is a fairly popular topic today, with the media spending as much time on the energy crunch as on rich Arabs. This is, in part, due, no doubt to this country's great dependence upon oil for everything from gasoline to plastics. It is a substance that can be used for virtually anything. Because of this, much research, time and money have been spent to explore the use of oil for many things besides using it strictly for its heating capabilities. But oil is the undisputed king of B.T.U.'s.

Natural gas -- 950-1050 B.T.U./cu. ft.

Butane gas -- 3210 B.T.U./cu. ft.

Propane gas -- 2558 B.T.U./cu. ft. or 93,500
B.T.U./gallon

#2 Fuel oil -- 135,000-139,000 B.T.U./gallon

Electricity -- 29.3 K.W.H./100,000 B.T.U.

Air dried hickory wood -- 24,200,000 B.T.U./cord

Air dried aspen wood -- 12,300,000 B.T.U./cord ³

Oil comes in seemingly endless varieties and viscosities, but most potters are concerned with fuel oil, either kerosene, heating oil or one of its thicker and heavier brothers. In general, the thicker the oil, the higher the heat potential and cheaper per gallon cost. However, the catch is that the heavier the oil, the less readily it breaks down and burns, and the more subject it is to temperature changes. Thus, Dennis Parks, who uses both purchased diesel fuel and used motor oil he collects

free, had to design a system of heating and filtering the thick sump oil for winter use. Even in warm weather, sump oil is very viscous. In the cold, it becomes like jello.⁴

For my kiln, I chose to use a furnace burner which is designed to burn the much lighter (both in color and density) fuel oil. Fuel oil is caramel colored and pours like water even when cold. Thus, relying on a pre-engineered and sophisticated technology, the potter can become something of a technological parasite in that one is able to design a system for firing a kiln that, while being highly engineered, is fairly inexpensive. In many ways, this echoes all aspects of studio pottery in that much of what we use in the way of clay and chemicals are designed primarily for industrial use, not even necessarily having any connection with ceramics whatsoever.

The kiln that I chose to build was a catenary arch, downdraft kiln built of $\approx 2600^{\circ}\text{F}$ and $\approx 2000^{\circ}\text{F}$ insulating firebrick. (See photographs and descriptions.) I chose the catenary arch for ease of construction and to avoid the expense and time involved in the steel bracing that a sprung arch would have necessitated. Bob Schmitz and I worked out the design after much deliberation, neither of us knowing exactly what it meant to build a kiln for oil firing. I knew what a normal catenary arch kiln looked like so I rather blindly began. Fortunately, the design

had some built-in flexibility which later proved useful and necessary.

About this time, I visited Sprontz Incineration here in Rochester and discussed his use of oil burners on incinerators. I also had written to a potter named Bill Troxell, concerning his oil-fired, salt kiln in Oxford, N.Y. I explained my project and what I hoped to do and asked if he would be kind enough to jot down his thoughts on oil-firing and send them to me in the self-addressed, stamped envelope that I had provided. It proved to be a great maneuver on my part as Bill wrote back immediately and has provided much information in subsequent correspondence. (See letter in appendix) He, it turned out, has a rather large kiln (80 cubic feet) and uses two home furnace burners to once-fire his salt glazed pottery. At his suggestion, I made use of the false burner port that I had built into the front wall of the kiln and filled in the side port. I decided that the oil might burn better if given the entire length of the kiln rather than the 9" space that would be adequate for a gas fired kiln.

Another major compromise was made after the initial design sketches were done and the space in the building was measured. Originally, my design called for a strict cross draft kiln with a burner directly opposite the chimney. When I took the initial measurements of the concrete pad and the space between the wall of the

building and the chimney, it became apparent that the arch was too wide to fit as drawn. As a result, the design had to be reworked and the arch turned 90° so that the burner and chimney were now at a right angle. This design has resulted in a cold spot in the bottom, right-hand corner of the kiln where the flame has no real reason to travel and where it doesn't get radiant heat from the firebox area. A solution to this problem would be to use a twin firebox design as is used on the wood kiln at R.I.T. which is of similar design. In fact, that kiln has, so far, tended to fire hot on the bottom. While the cool spot in the kiln was troublesome initially, some rearrangement of the bag-wall, judicious stacking, and a soaking period at the end of the firing, has made the problem minimal. Two burners would eliminate the problem altogether and make for a more even heat distribution in the kiln.

Another problem that I encountered and one which I did not foresee, was the angle of the oil spray produced by the burner and its effect on burner port design. The burner port that I had built was $4\frac{1}{2}$ " wide by $7\frac{1}{2}$ " high with a straight walled, 9" hardbrick corridor that led into the firebox, as one would normally build for use with gas or wood. I had read and it seemed logical, that the best nozzles to buy for my oil burner were low angle nozzles. Nozzles (orifice is a dirty word in the oil

burner business) are rated by the rate of oil they will pass (gallons per hour) and by the angle of spray emitted. I use four nozzles all rated at a 45° angle of spray (.75, 1.50, 2.25, 3.00 gallons per hour). I have read that the 30° nozzles are available but I was unable to locate them. In any case, when the oil is pumped through the tiny nozzle, a fine spray is emitted, similar to an atomizer. Since the burner head stays right at the opening of the burner port, the 45° spray was hitting the two side walls thus causing incomplete combustion and a build up of clinkers (unburned carbon). During the first firing, this became quickly apparent and if not scraped, caused smoke and could even seal off the secondary air to the kiln. After that firing, which was successful in all other respects, I reread the articles I had on oil firing and promptly wrote to Bill Troxell and another potter, Neal Redmond, who I knew used this type of burner. I knew that the problem was that the oil was coming into contact with the relatively cool surface in the burner port and not burning properly, but building up in the form of carbon clinkers. The solution became apparent when I looked at the burner port area designs in British oil kilns and modern oil furnaces. I needed a quarl, a shaped burner port which would flair out toward the interior of the kiln and thus provide ample room for the fine spray to burn.⁵ Altering this meant tearing down

the left front side of the kiln and cutting angled hard brick to create an angled burner port. This worked wonders and greatly reduced smoking and carbon build up. (It should be noted that care should be exercised when scraping clinkers around the burner port. The burner should be shut off as the transformer puts out 10,000 volts).

The oil is quite harsh as a fuel and I have read that it is damaging to refractories. I personally have noted rather severe heat flashing on my glazes although my clay body seems to take the heat well without warping. On one particular matt glaze, I can see a much wider variation in maturity from one side of the pot to the other. This is not due so much to uneven firing as it is to the pots having been either too close to the firebox area or in the direct path of the flame when it is still at its harshest. I have had this glaze go glossy on occasion when placed too close to the firebox. The kiln also reduces stubbornly at best and my clay body is usually more evenly reduced in the top of the kiln than in the bottom. Since the kiln fires so efficiently, reduction is a problem. In fact, there is no flame whatsoever at the damper until the last nozzle is put on and glaze reduction begins. The efficiency of the burner seems to preclude any accidental flashing.

The lack of reduction is another major stumbling

block in oil firing. Since my clay body, and in particular, my glazes are at their best in a reducing atmosphere, I attempted to attain similar results in my oil kiln. Oil, however, is a fuel that seems to be devoid of reduction, going from oxidation to black soot with no middle ground. This is especially true with a highly efficient oil burner such as mine. Great quantities of smoke usually do not help the situation and can cause carbon trapping in glazes. At the present time, I am still experimenting in this area but I think I have, in the process, stumbled upon some interesting ideas. The first has to do with Leach's account of oil firing, which I have already referred to, and Olsen's wood/oil firing.⁶ When I initially read their accounts, I thought that their continued use of wood and stoking was simply a holdover from their all-wood firing days. I'm sure now that they rely on the wood for reduction, to avoid oil soot and to achieve reduced firings with oil that are similar to their all-wood firings. I have tried this to a degree in my kiln and have had some success. This seems to me to be a good solution to the problem.

The other idea on which this problem shed immense light was the use of oil as a fuel for salt-firing. Having salt-fired with gas for two years prior to coming to R.I.T., I have a distinct soft spot in my heart for the process and its effects. The characteristics and

high heat potential of oil make it ideal for salt-firing. While racking my brain about the lack of reduction in my oil kiln, it struck me that this would be ideal for salt-firing where a light-colored ware is usually desired. The salt could be held in the kiln by shutting the damper with little fear of reduction unlike with gas. In addition, the high heat potential of oil makes salting easier with little or no recovery time between saltings. Bill Troxell states further that the use of a liquid fuel enhances the reaction of the salt in the kiln. I have found it virtually impossible to stall my oil kiln and I have never seen cones drop as fast. Once the kiln reaches cone 08, one must be very careful not to fire too fast. Long, stubborn firings do not happen in my oil kiln. It fires the same each time and the cones drop right on schedule. The sense of reserved power that Leach spoke of is a useful thing.

In terms of fuel costs, oil compares favorably with gas while having a large power advantage. (See fuel consumption statistics and costs in appendix) The possibility of using cheaper, heavier grades of oil and even used crankcase oil are all considerations of time and practicality versus expense, yet, no doubt, great saving could be realized.

The initial investment, as I have tried to indicate, can also be dramatically cut as compared to gas. In

addition, its refusal to burn unless properly atomized and regulated, is a quality which makes oil a safe fuel to use and store.

Part II

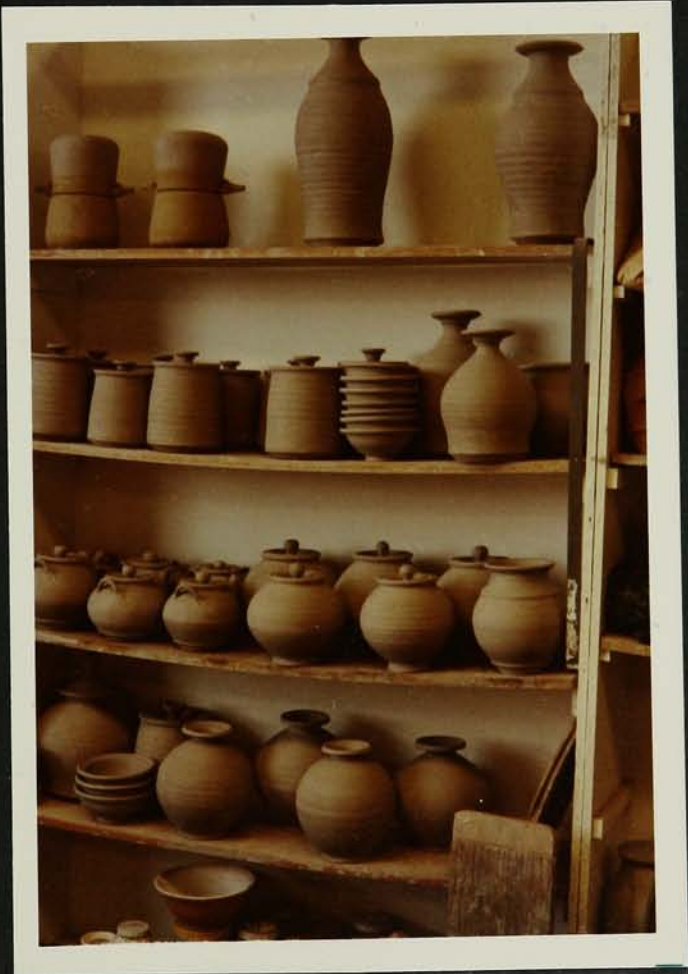
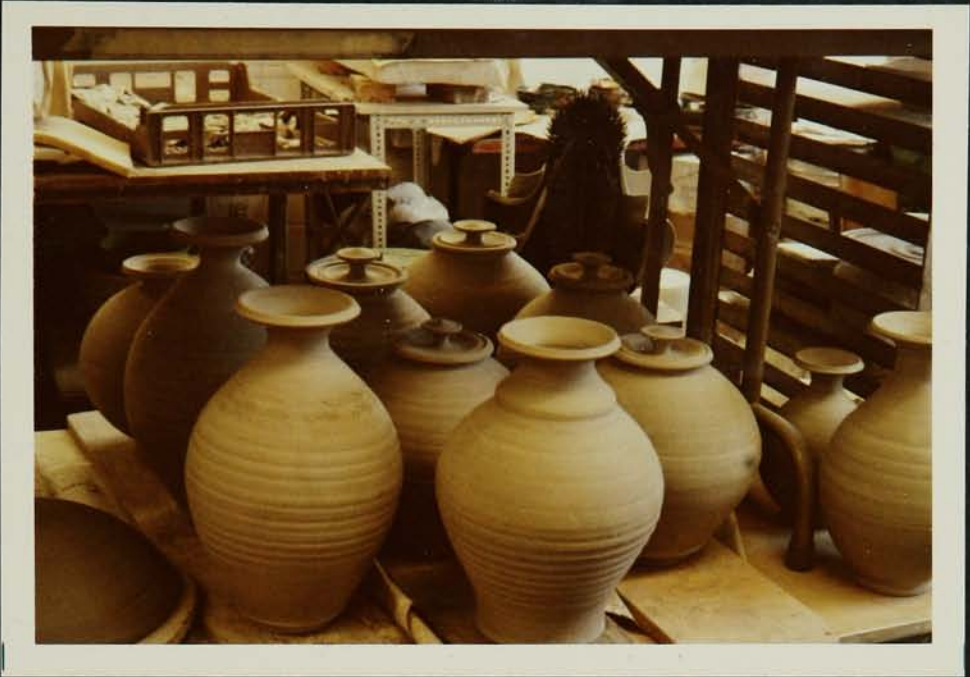
THE WARE

In deciding what type of ware I wished to produce for my thesis, two items of concern influenced my decision. On the one hand, I wanted to continue my work on production items in order to keep the work that I began at R.I.T. moving forward and not have it suddenly halted. In addition, I saw the opportunity to produce some larger pieces of a more experimental nature for the thesis show. These two objectives have complemented each other nicely with the production work assuring frequent firings and testing and insuring efficient use of space in the kiln. It seems wasteful to me to produce only large pieces that generally make for an inefficient stacking. Furthermore, the production ware has helped to defray some of the expenses involved in the making and firing of my pottery.

Prior to coming to R.I.T., I had used the pottery wheel in a totally different manner. At that time, I was salt-firing and interested in creating larger pieces that made the best use of the rich, salt-glazed surface. The pieces usually just fit in the kiln so that no shelves were needed. I used the wheel frequently but in much the same way as I used my plaster molds. It was a tool on which I was able to produce the shapes or parts that I wanted to use. Hence, I rarely produced a finished piece on the wheel but rather I made parts to be assembled later, often in conjunction with molded

pieces.

I did, however, use the wheel enough to realize that to produce finished pieces, and pieces of similar shape and design would require much discipline and hard work. As a result, upon coming to R.I.T., I decided to concentrate my energies on wheel work and my technique. Having had to split my time for the last two years between my job and my claywork, I decided to devote my time to throwing and functional design, in an effort to help bridge the gap between one's job and one's claywork. Furthermore, I looked forward to the challenge that this presented. The discipline involved is a good thing, I feel, and essential if one is to thoroughly explore functional design in an attempt to develop one's own style and way of working. The challenge that I saw in executing a well designed and functional cup, for instance, intrigued me and continues to do so. The skill required in repetitive throwing is something that I admire very much and that I continue to explore. I continue to look for better ways to do things and am constantly looking at the way other potters have solved the various design problems inherent in functional ware. However, I firmly believe that one's best influence and teacher rests in the long hours of work and the discipline required to begin anew after failure. For this reason, I believe in producing alot of work.

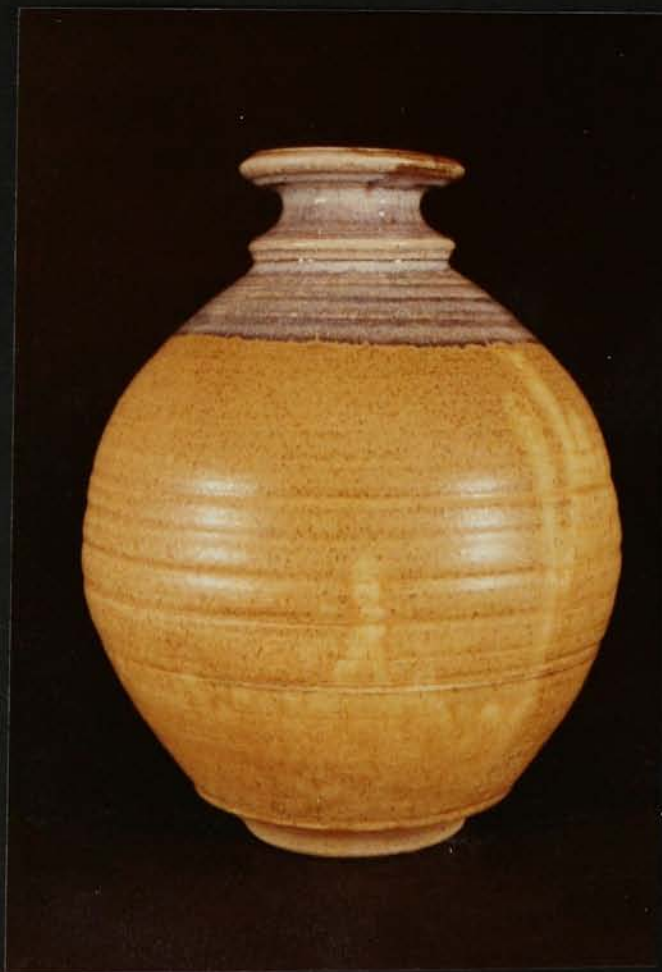
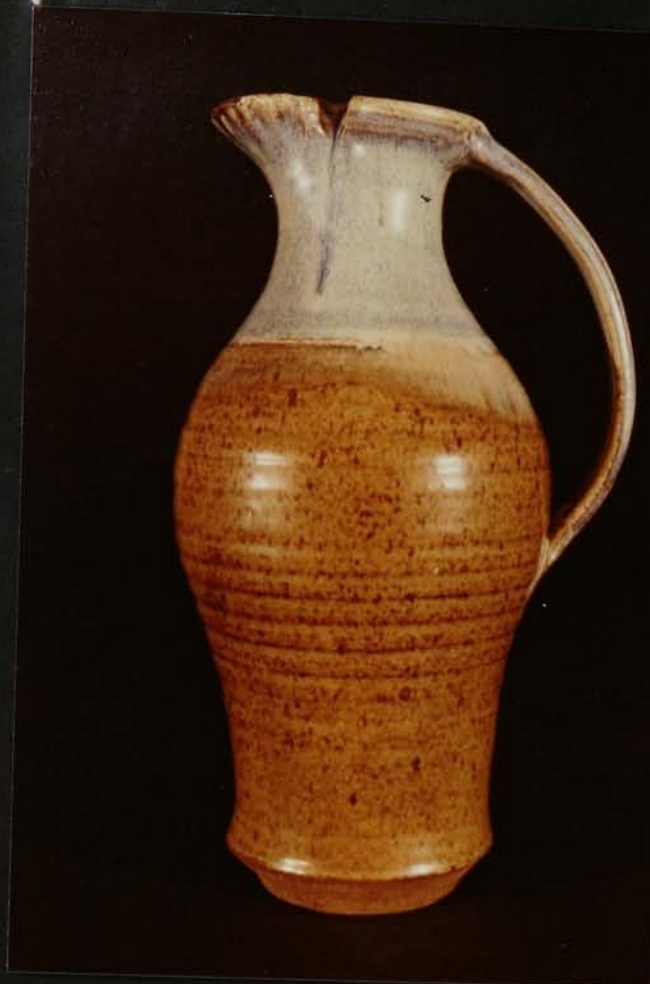




Unless one can draw very well, I believe, one is best off sketching on the wheel itself. Granted, a firm idea and perhaps some pencil sketches should always be made before one begins at the wheel. The most important process, I feel, is the constant work and continual "evaluate and improve" process that should accompany each cycle of working and firing.

Up until my thesis project, this is what I have been involved in doing. I have been trying to develop a well-designed, saleable line of work and a style that says something about my feeling toward pottery making. My primary concern remains unchanged and I am more interested in making pots than talking or writing about them. I do feel, however, that I personally, and my pottery has been influenced greatly by the thoughts and writings of other potters, particularly Bernard Leach and Michael Cardew. Furthermore, I do feel, as I have tried to indicate, that one's self-discipline and evaluation of ideas is of the utmost importance. One hopes that one can produce enough work to pay one's bills, for work generates ideas and the time to work is only available if one can support oneself from one's work. Otherwise, the work and time spent at it, must surely decline. Thus, it follows that I further believe in building large kilns for they are always more efficient and





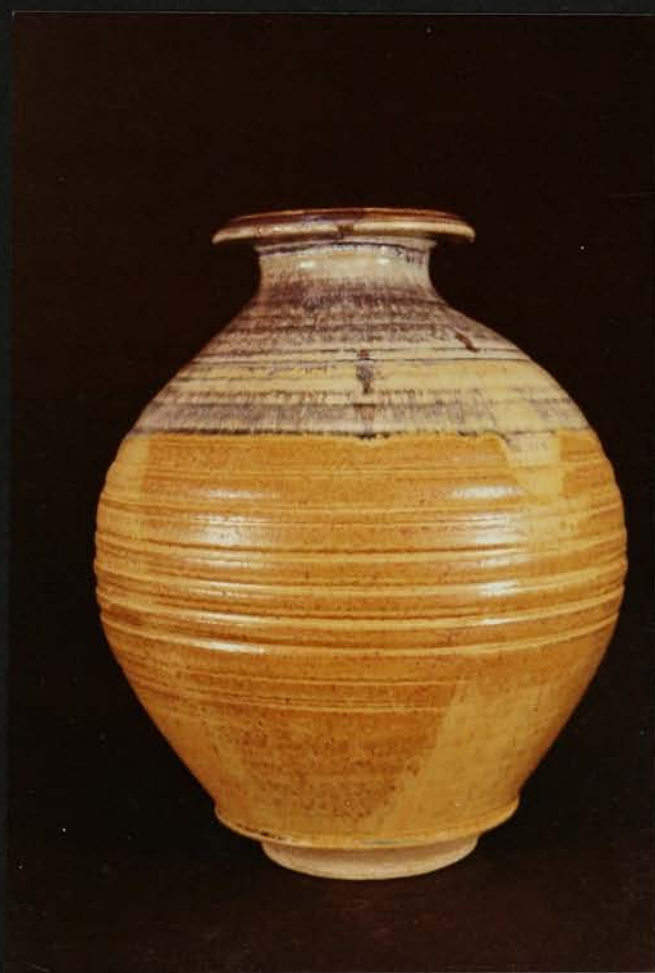
usually fire better. (See fuel consumption figures in "Something more about stoneware kilns.")⁷

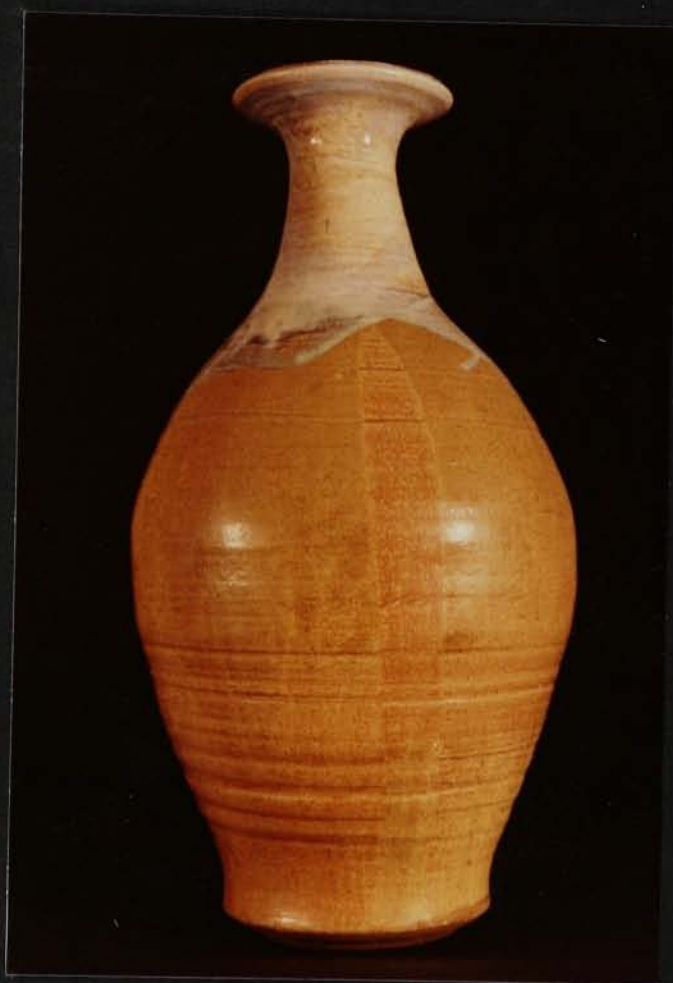
In addition to continuing my production work, I began to explore larger thrown pieces and sectional forms. I have found that one's clay body and clay preparation habits are critical when working with larger forms in particular. The clay body that I use can really only be estimated in that it is always made up with a considerable amount of reclaimed and slaked clay. In addition, I frequently change the body if I feel that it requires some adjustment. I have no doubt that if I made up the following clay body and used it, it would differ from the clay I am presently using. Nonetheless, I use the following recipe to add to my reclaimed clay to stiffen it up:

Cone 9-10 Stoneware

A.P. Green's Missouri Fire Clay	25
Pine Lake Fire Clay	25
Cedar Height's Goldart	30
Kentucky "Special" Ball Clay	20
Potash Feldspar	8-10
G - Grog	3-4

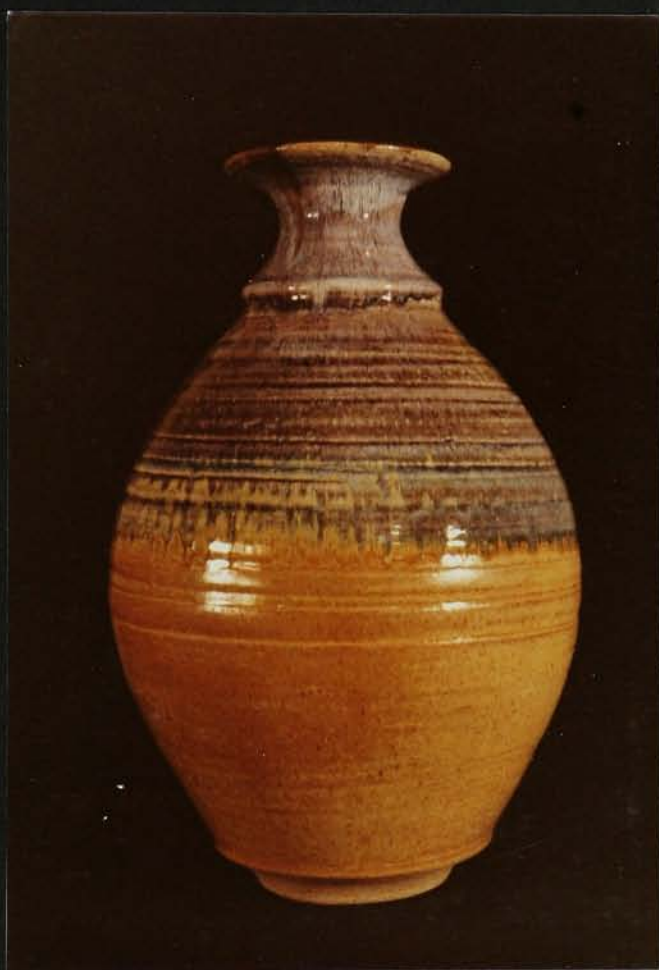
I might add that, having been a salt-glazer, I never encountered the demon known as shivering or spiral cracking until I came to R.I.T. The 8-10 potash feldspar is a must if one is using glazes. Furthermore, one might

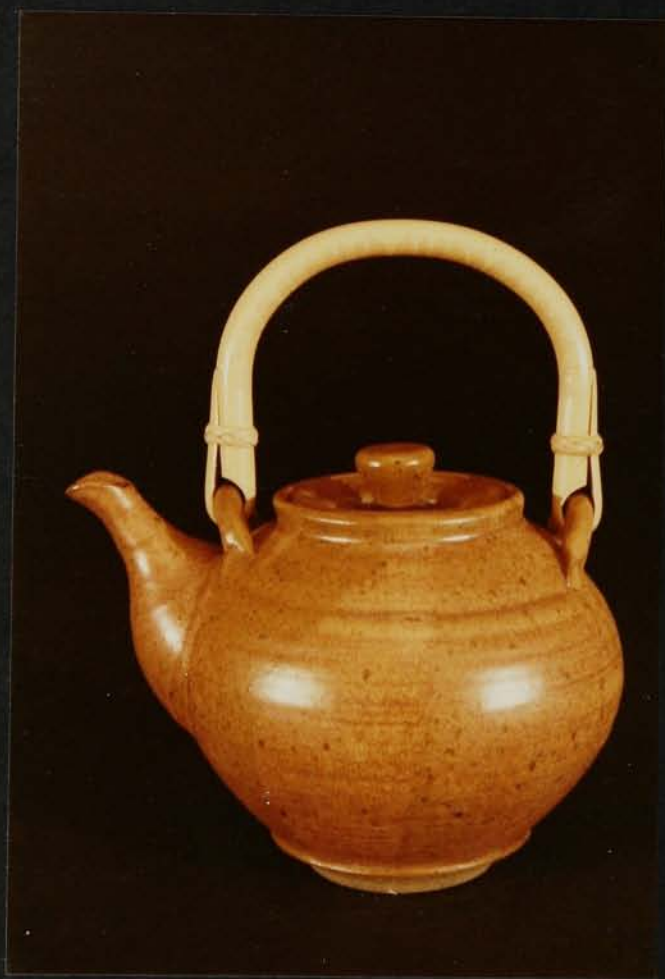




add 1-10 flint to the body if crazing occurs. I usually make clay when one garbage canful remains unused, this being 200-250 lbs. of clay. This usually insures at least a week of aging and preferably more. I believe strongly in the benefits of using well-tempered clay as I have found old clay to be better than new, freshly mixed clay. This is particularly important when one attempts to make larger thrown pieces. I usually use the clay stiffer as well, in order to negate the longer time that I will have to spend centering and throwing the pot. Well aged clay is also useful in making the large bowls or very wide-bellied forms that I am fond of as it doesn't crack open when expanded almost to its limit.

Making larger pieces only exaggerates what throwing is all about, and that is, finding the limit and coming as close to it repeatedly without going too far. My best pots, I feel, are those which combine a sense of having been thrown swiftly and vigorously with a feeling of being stopped just at the brink. For this reason, I tend to favor wide, flaring lips that, on the one hand, are thick and visually in harmony with the scale of the piece, and on the other hand, are flared to the point of being exaggerated. I make many pots, but few combine all of these elements in just the right way. Few have the right amount of exaggeration, vitality and control to be special, but it is the one that does, that keeps





me interested and exploring.

The sectional vases that I made ranged in size from 24" to 26" and were all made in two initial stages. The bottom is thrown, establishing the upward slope and width of the piece. The center section is thrown upside-down as a bowl form. When properly dried, the two are joined and recentered on the wheel where a thick coil is added to the top and thrown.

I had tried this technique and its many variations before but never to my satisfaction. These sectional pieces are reasonably scaled and close to my original drawings in form. In addition, they seem to fire very well, despite rather rapid drying.

I have also done some experimenting with wax resist decoration on my large platters and bowls. The flatter, more two-dimensional surfaces of these forms seem to take this technique very well and when fired properly, the two glazes blend just enough to make the pattern come alive.

In general, I have tried to produce pieces that best illustrate my ability and style. I tend to enjoy the spiraling finger rings on my pieces while attempting to balance the foot and rim of the piece. The most successful pieces retain, after the firing, the same vitality and freshness that they had when just thrown. While the shapes may change, I continue to work to

produce pieces that are vigorous and strong.

CONCLUSION

In conclusion, I feel that my project has been a successful one. I was able to spend a lot of time studying and learning about kilns and their operation and oil kilns in particular, of course. The project also heightened my awareness of the aesthetic and economic considerations involved in kiln building and firing. There are real differences between oil and gas firing and I have noted them in terms of economy, ease of operation, clay body color and glaze quality. In the final analysis, however, I feel that one must explore these possibilities personally. Only by doing this can one know what is right for one's own work. I am glad that I had such an opportunity and I am sure the knowledge will be very useful in the months to come.

I look forward to using what I have learned doing this project to continue my work and to produce ware that will be enjoyed and appreciated by those who seek it out.

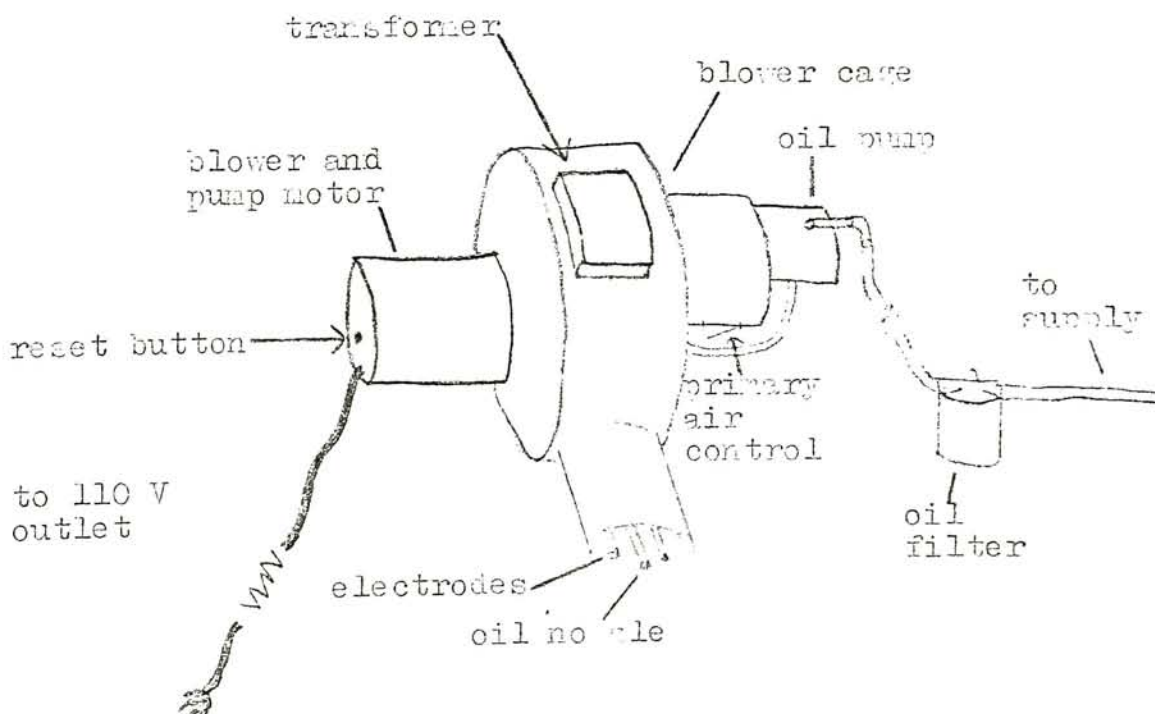
APPENDIX

The purpose of this thesis is to explore the possibility of using fuel oil to fire functional pottery. I hope to design and build a modest sized catenary arch crossdraft kiln to be fired with oil. For efficiency and reliability, the burners used will be home furnace burners. I intend to explore and record the effects of the oil firing to determine in what ways it differs from firing with gas. Comparison tests for body color and glaze effects will be undertaken to help determine this. The ware will be fired to stoneware temperature (cone 9-10) and designed and glazed in such a way as to enhance the effects of the oil fire. I hope to design pieces that will be a true record of the effects of the firing in terms of body color and glaze. The oil firing should, by virtue of its long flame (similar to wood), make its mark on the ware through flashing and subtle color changes. The pieces will be wheel thrown and will be designed to make the most of the long flame and flashing that oil produces.

Basic Gun-Type Oil Burner

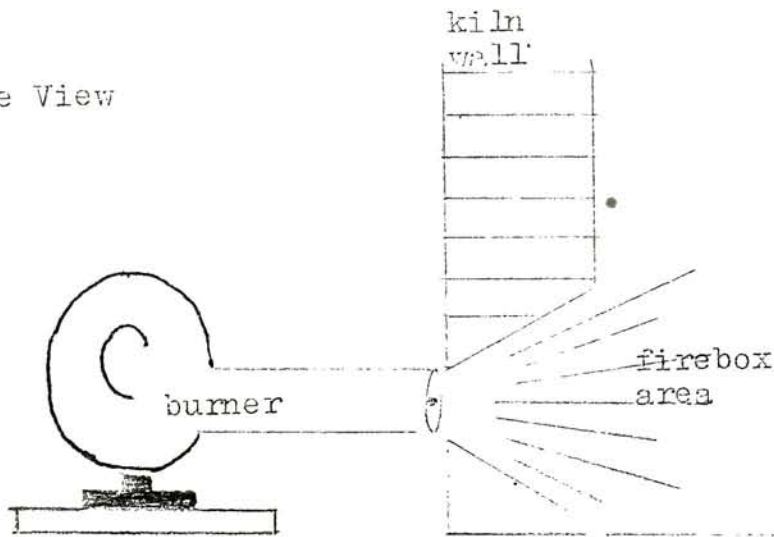
A ceramic fiber collar is used to seal off secondary air during initial stages of firing.

Four increasing sized nozzles control the amount of oil used.



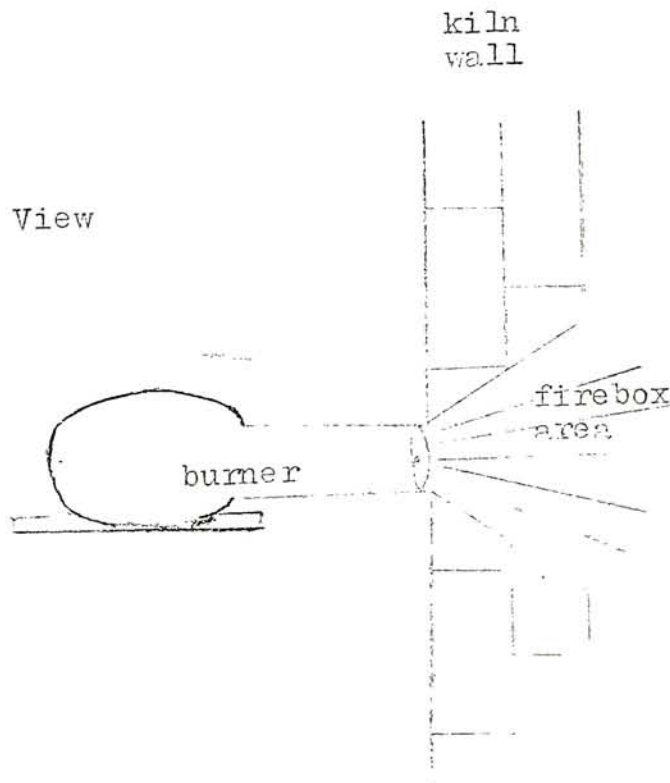
Burner Port Design for
Atomized Oil Film

Side View

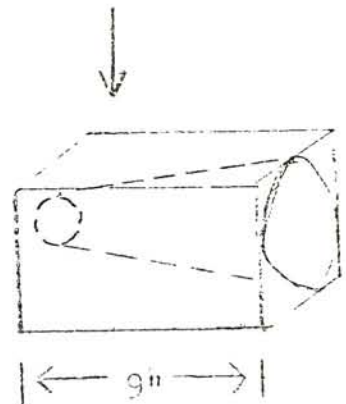


This burner port eliminates carbon clinker build-up and increases flame efficiency.

Top View



A cast burner block might be the best solution



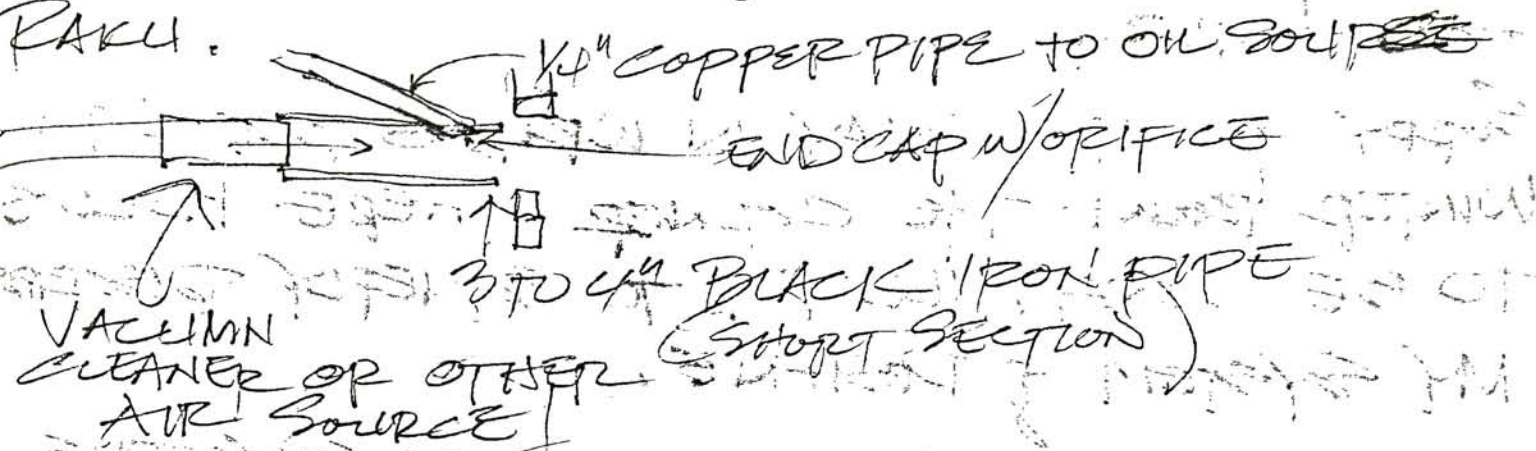
10.16.78

DEAR PETER

SORRY FOR THE DELAY IN WRITING BUT WITH WINTER ROUND THE CORNER THERE IS LOTS TO BE DONE, ILL TRY TO BRIEFLY DESCRIBE MY SYSTEM & DESIGNS.

I HAVE WORKED W/ 4 SEPARATE OIL SYSTEMS WITH VARIED SUCCESS. IN ASIA A TYPICAL SYSTEM STANDARD TO A LEACH OR CAPDEN CONSISTS OF A SERIES OF DRIP PLATES TO ATOMIZE THE OIL — IT WORKS, PRIMITIVE AT BEST & DIRTY SECONDLY, A LARGE COMMERCIAL BURNER WITH PREMIX BURNER BLOWER SYSTEM ON A ROMAN ARCH KILN AT BRUNO LA VERDIER'S POTTERY. FIRING CHAMBER OF ABOUT 180 CM. FT — THE FLAME WAS SEPARATE OF THE CHAMBER IN ITS OWN FIRE BOX WITH A SERIES OF BAFFLES. IT ALSO WORKED VERY WELL EXCEPT THE OIL LINE WOULD FREEZE IN THE WINTER [SUGGEST ADDITION OF SMALL AMOUNT OF KEROSENE TO THE FUEL OIL] THIRDLY, A RAKU KILN WITH OIL PIPE (55 GAL DRUM) MIXED WITH AIR FROM A VACUUM CLEANER — SIMPLE — EFFICIENT BUT REAL FAST FOR

RAKU.



LET'S SEE IF I CAN FINISH THIS UP] LASTLY, THE
SYSTEM THAT I HAVE ON MY KILN AT PRESENT.
SPRING ARCH SALT - 80 CU. FT. LOAD SPACE ABOUT
60 CU. FT. - HARD BRICK INTERIOR - 1" OF
8 oz. KAO WOOL BLANKET 2400° - AN EXTERIOR
LAYER OF RED BRICKS. 12" STACK OPENING
A 24 FT. STACK. OTHER THAN \$2000 FOR
THE REFRACTORY BLANKET & SOME SURGE
THE KILN HAS COST NOTHING (ALL SALVAGE)
USE TWO HOUSE BURNERS - BOTH ARE
SALVAGE W/ TWO BACK-UPS (TO DATE UNUSED)
THE BURNERS ARE SIMPLE IN PRINCIPLE
AS WITH ANY OTHER OIL SYSTEM ATOMIZING
THE OIL IS CRITICAL - SO IT HAS A FAN
W/ MOTOR. THEY HAVE TRANSFORMERS
PRODUCING 10000 VOLTS W/ IGNITERS TO
LIGHT THE FIRE. PLUS THE OIL SOURCE
BEING PUMPED THRU AN ORIFICE. THE
NOZZLES W/ VARIOUS ORIFICE SIZES & SPRAY
ANGLES [30° TO 90°] ARE USED. 30° SPRAY
IS A LONG NARROW FLAME

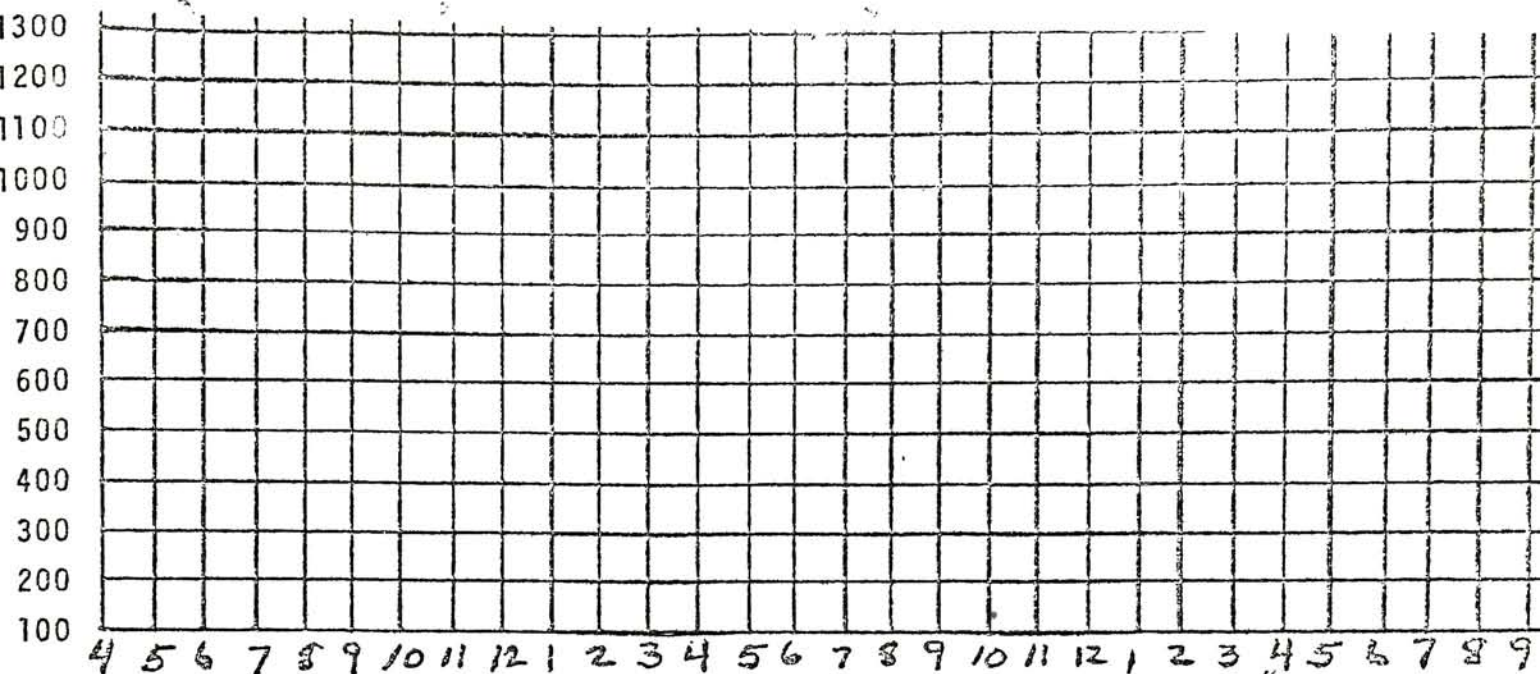
-3-
IS MOST SUITABLE FOR A KILN PLUS I CAN
US A 9" WIDE FIRE BOX RUNNING THE
LENGTH OF MY KILN [4 FT]. I CHANGE ORIFICE
SIZES ON EACH BURNER 4 TIMES A FIRING
.75 GAL. PER HR. TO 3.00 GAL. PER HR. OPTIMAL
FIRING TEMPERATURES OCCUR IN THE MID
RANGE SO I SLOWLY INCREASE THE TEMPS
WITH CLOSE INTERVALS OF CHANGES &
SLOWNESS. CRITICAL TO BE AS I ONCE
FIRE ALL OF MY SALT POTS! I HAVE
HAD NO ADVERSE INFLUENCE ON MY GLASS
BECAUSE OF THE OIL FLAME. GOOD RESULTS
BY REGULATING THE AIR ON THE BURNER
ALSO CRITICAL TO FLAME EFFICIENCY. AND
THE SALT WHICH NEEDS MOISTURE TO VOLATILIZE
GETS THIS FROM THE LIQUID OIL BEING
BLOWN & ATOMIZED BY THE BURNERS.
DEAL! I WOULD LIKE TO EXPERIMENT W/ A
SMALL KILN USING SALVAGE OIL BUT
THAT WILL COME IN TIME... AND THEN
APPLY THOSE RESULTS TO A LARGER 3
CHAMBER KILN. OTHER CONSIDERATIONS
WOULD BE — THE AVAILABILITY OF OIL
IS EVERYWHERE AND WITH THE BTU'S
PRODUCED PER GALLON BEING GREATER
THAN GAS @ 48¢ PER GALLON ITS CHEAP.
ONCE FIRED [18 HRS], SALTING, HARD FRICK
KILN COSTS ME \$38.00 EACH LOAD OF
PROX. \$1500.00 WORTH OF WARE — AND
THATS CHEAP! SALVAGE BURNERS ARE
* THE TECHNOLOGY

-4-
sophisticated enough to be efficient
but under standards to a simple
potter. Oh, yes — NO FIRE HAZARDS,
NO FUMES TO EXPLODE — TRY TO LIGHT
A PUDDLE OF FUEL OIL. NOTHING!

SO PETER, BRIEFLY, THATS IT. THE
BEST TIME TO SEE THE SYSTEM IS
DURING A FIRING! YOU ARE WELCOME
ROCHESTER IS 2 HRS TO OXFORD, JUST
LET ME KNOW & I'LL GIVE YOU A FIRING
DATE [FLEXIBLE]

BEST WISHES & GOOD LUCK @ RIT.

Paul Troxell



4th fire

3. _____

Write in
time when
burner
is lit

4. _____

KILN oil kiln

DATE 2/8/79

1. _____

2. _____

STACKERS Reagan

160° windy, scattered clouds

TIME	TEMP.	DAMP.	REMARKS (Changes in Flame-Damper-Color-Pressure, etc)
7:30 AM	cold	$\frac{1}{2}$	1.75 oil (chimney ^{white smoke} warm from wood fire)
10 AM	warm	3"	1.50 white smoke
11 AM		2"	soot off top sec open $\frac{1}{2}$ "
12:10 PM			soot off both joint color top
12:30 PM		1"	2.25 oil sec open $\frac{3}{4}$ " pressure for 1000
1 PM			D08 down top some chicken
2:30 PM			D03 r top
2:40 PM			D08 r both D03 down top
3:20			D1 r top
3:35			D3 down top
4:35 PM		1"	D5 r top cold both soe pressure + soot
5:20			3.00 oil sec open smoke on the at 2000
6:25			D10 r top D5 down both using wood
6:30			D10 down top D5 r both
6:45 PM			off D10 down top D9 r both
used 20.50 gallons in 11 hr			
some wood used for reduction - 1 hr. reduction			
moderate. Most even yet.			
R-115: decent reduction, good			

smoke

Fuel Consumption of Kiln

	Length of Firing	Gallons Used	Cost*
First Firing	14 $\frac{1}{2}$ hrs.	28.50	\$16.81
Second Firing	11 $\frac{1}{2}$ hrs.	22.2	\$13.09
Third Firing	11 $\frac{1}{2}$ hrs..	22.	\$12.98
Fourth Firing	11 hrs.	20.50	\$12.09

(See schedule in appendix)

*Cost - figures are based on paying 59¢ per gallon delivered, the current rate for fuel oil. In fact, I bought my oil privately and paid as low as 25¢ per gallon.

FOOTNOTES

¹A Potter's Book, Bernard Leach, pp.248-253.

²"Studio Pottery," Summer 1974 Vol.3 No.1, "Adapting fuel oil burners to ceramic kilns," Joseph and Marcia Selsor Mannino, pp.53-56.

³Kilns - Design, Construction & Operation by Daniel Rhodes, p.68.

⁴"Studio Potter," Summer 1976 Vol.5 No.1, "Fired Free" by Dennis Parks, pp.71-74.

⁵Kiln Building, Ian Gregory, pp.14-15.

⁶The Kiln Book, Frederick L. Olsen, pp.140-142.

⁷"Pottery in Australia," "Something More about Stoneware Kilns," John Edye, Vol.16 Number 2, Spring 1977, p.25.

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- Stannard, Ann. "Drip-Feed Oil/Water Burner," article in "Studio Potter," Vol.3 No.1, Summer 1974, pub. by Daniel Clark Foundation, N.H., pp.51-53.